Electrical World

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Fighting Water with Water

Resourcefulness of engineers in emergencies was much in evidence during the recent flood period in various sections of the country. Many of the plans put into successful operation at that time were well worthy of note. Perhaps the most interesting solution found for the problem of keeping water out of a station and preventing the building from being carried away by the flood was that to which attention is called in this issue. A destructive agent was used against itself with telling effect, first as a barrier to hold back the rushing tide which threatened to engulf the electric-light station and then as ballast to thwart its attempt to lift the station bodily and hurl it to destruction. Windows and doors of ice were never before used as bulwarks against a flood, nor was a leak in the cellar ever considered desirable. The engineering plan employed to combat the forces of nature at Louisville was certainly unique and withal successful.

The Institute as Defendant

Attention is called elsewhere in this issue to a suit to restrain the American Institute of Electrical Engineers from transferring any person to the grade of Fellow or Member in accordance with a special section of the Institute constitution which has been in effect since June, 1912, and will expire on May 1, 1913. This suit has no bearing on the division of the membership into three grades or the establishment of the grade of Fellow. It would seem, in fact, that all parties to the suit agree that the division represents a proper change in the organization and that the qualifications to be required for admission to the upper grades after May 1, 1913, are satisfactory. The point under contention relates exclusively to the legality of the so-called special section of the constitution in accordance with which any person formerly belonging to the Institute can be transferred upon proper certification to a higher grade, provided he applies for transfer before May 1. The claim by the persons bringing the suit is that the special section is nullified by other parts of the constitution with which it is in conflict, and that transfers made under this section are illegal. The point under contention in the suit is a perfectly proper one for discussion by the membership and officers of the Institute, but should not have been aired in public. In the interest of the professional standing of both the Institute and its members this quarrel should be settled out of court, and that very quickly. It can safely be stated that any injury to the Institute which might be caused by admitting partially qualified persons to the higher grades would be negligible in comparison with the discredit brought about by the present legal conflict.

Free Renewal of Tungsten Lamps

With the general tendency to reduce the price of tungsten lamps, it is safe to predict that before the end of the year central stations in large cities will find it to their advantage to place such lamps of the higher ratings on a free-renewal basis. While this is already true of the very large tungsten lamps designed to replace inclosed arc lamps, where maintenance of the latter is assumed by the lighting company, the time is fast approaching when those sizes of lamp in more general use should be included. To be sure, the energy consumption of the smaller sizes of tungsten lamp is such as to make it unwise, for the present at least, to include these in any free-renewal plan; but it has been demonstrated that where an 80-watt lamp, for instance, is offered at the same price as a 25-watt lamp, the natural desire to obtain the most for one's money prompts the choice of the larger lamp—much more so where the larger lamp may be had for nothing. There is nothing new in this, and since from time immemorial it has been a trait of humanity to be very free with that which costs nothing, there should be but one result following the free-renewal of the larger sizes of lamp while the smaller sizes must be paid for. More light, better illumination, increased consumption and greater satisfaction with the service are inevitable.

The Electrified Gasoline Automobile

With perhaps thirty applications of electricity contributing to its operation and convenience, the gasoline motor car of the near future is likely to become an electrified vehicle which will earn more of the central-station man's professional sympathy than it now gets in competition with his favorite battery-driven car. For right here in the young and restless gasoline-car industry there is going on a development of electrical auxiliaries which will, as one authority estimates, shortly be consuming $2,500,000 of electrical products yearly. The use of electricity for ignition, lighting and self-starting has already become standard in the motor-car field. But many other refinements and conveniences are now making their appearance. An electrically heated carburetor, for example, assures for one make of car accurate mixtures regardless of temperature. Electric heaters are a comfort in the limousine. Another inventor has produced an electrically heated steering wheel. Lamps arranged to turn on automatically and illuminate the step and sidewalk when the door is opened will be appreciated by women occupants. An electric searchlamp controlled by the hand so that it can be turned to read wayside signboards is useful for night touring. Sign transparencies which show which way the car is being turned should help the artful pedestrian dodger, while another device shows the way the driver means to steer.

Economical Application of Turbo-Generators

In this issue appears the second and concluding part of an unusually thorough-going account of the recent improvements introduced in the Cambridge (Mass.) central station, where low-pressure turbines have been installed with excellent results both in increasing the available output of the plant and in improving the net economy of the generating system as a whole, after going through those various phases of technical history which have fallen to the lot of most central stations. The present plant was built nearly fifteen years ago, following the best steam practice of the day. The generating plant was operated by high-grade compound condensing vertical engines with an admirable boiler plant. The steam plant in its present development is, as our readers will appreciate on examining carefully the details, thoroughly good and represents a high development of the station with reciprocating engines.

As time has gone on, the need for increased equipment has called for radical action, and after a thorough study of the subject it was decided to install low-pressure steam turbines running on the engine's exhaust. The steps were not taken without careful preliminary tests, and it is these tests which lend particular interest to the installation.

The first fact which came to the surface as a result of the tests of the engine under back pressure was that with the reciprocating engine, designed for a normal output of 500 kw, the greatest available power obtained under considerable loss of economy by operating the machine at atmospheric exhaust was 673 kw, while the addition of a low-pressure turbo-generator of a little over 600-kw rating, receiving the steam which otherwise at maximum load would exhaust into the air, would enable the extreme load to be pushed up to nearly 1400 kw, with a very material gain of economy. Tests of the completed installation were highly gratifying, for they showed that while the steam consumption of the reciprocating engine set, including all its auxiliaries, was about 22 lb. per kw-hr., the combined unit with greatly increased output consumed only 17.3 lb. per kw-hr. The test results are in accord with the known fact that the last end of the steam expansion is much more valuable in a suitably proportioned low-pressure turbine than it is in an engine cylinder.

Since the first installation was made, a 1500-kw low-pressure turbine of similar character has been added. The result of the first winter's service with the renovated plant showed 10 per cent saving in coal consumption. Probably not all of this is to be credited to the low-pressure turbine since automatic stokers were introduced about the same time and more care was taken with the loading of the units. A test with the turbine out of service caused the coal consumption to jump 6 per cent, so that it is fair to say that in the neighborhood of two-thirds of the winter's saving should probably be credited to the turbines. The Cambridge plant has been in skilful hands of late and the recent improvements bear witness to the effect of good management on station costs. From the commercial standpoint the system has been well handled. Those of our readers who are interested in the problems of commercial development will find much worth study in the description of the Cambridge system. A prominent feature to which attention might well be directed is the arrangement for off-the-peak service to be applied to battery charging, cooking and heating appliances, pumping and refrigeration plants. The specification is that from Oct. 20 to March 10 no service shall be used between 3 p. m. and 6:30 p. m., and the price begins at 5 cents per unit for the first 70 kw-hr. per month and drops down to 3 cents and even 2 cents for large consumption. Certain classes of work can be managed very comfortably off the peak, and the special rate for such cases is well deserved. This plan should prove profitable for both the station and the consumer.

The Computation and Subdivision of Electric Conducting Networks

The computation of voltage and current distribution over electric mains or conducting networks is a special subject with a large literature, most of which has been published in the German language. A contribution to this literature, mainly from a historical standpoint, has recently been presented in *Elektrotechnik und Maschinenbau*, by Mr. Josef Herzog, who has taken for many years a notable share in the development of this important branch of electrotechnics. It is remarkable how closely analogies may be traced between the statical relations of masses suspended on strings and the electrical relations of loads carried on conductors. Many of these propositions are now currently known to electrical engineers; but the history of their development is by no means so generally understood.

The Reactance of Stranded Conductors

Although the reactance of transmitting or distributing wires does not, in the ordinary sense, absorb energy, yet it may play a very disturbing part on the pressure regulation of the circuit to which the wires belong. The inductance and the reactance of such wires is thus a matter of considerable practical importance. The ordinary formulas for determining the reactance of aerial conductors such as are used in transmission lines are based on the assumption that those conductors are solid wires. But many such conductors now in use are stranded. The question naturally arises, What effect will the stranding have upon the resistance, inductance and reactance of such conductors? The effect is always to increase the resistance slightly, because the conductor is virtually lengthened by the helical lay of its strands. In an article by Mr. H. B. Dwight on page 828 of our last issue the question of the reactance was considered. Assuming that the conductor is not large enough to introduce any serious amount of skin effect, it is shown how the inductance and reactance of stranded wires may be computed.

One effect of stranding a conductor is necessarily to increase its diameter by comparison with the solid or unstranded state. The effect of increasing the diameter of a wire, everything else remaining the same, is to diminish the inductance and reactance of the wire. In general, the article indicates that when the virtual diameter of a conductor is increased by stranding the reactance is diminished,

but not to the same extent as though the conductor were solid with the strand diameter. Stranding, therefore, slightly increases the resistance of a conductor, and slightly diminishes its reactance.

Investigation of Diffusing Glassware

With feeble illuminants, such as candles and ordinary flames in air, their brightness is a matter of relatively little significance and the more numerous the illuminants the greater their total illumination effect as apparent to the eye. When, however, use is made of intense illuminants, such as arc-lamps, intensified flames and metallic-filament incandescent lamps, their brilliancy often detracts from their effectiveness.

The retina of the eye can support only a certain intensity of illumination, as measured, say, in lumens per square millimeter of retinal surface. If the intensity is raised beyond the critical value, the nervous mechanism of the eye is automatically invoked to stimulate the curtaining muscles of the eye—the muscles of the iris diaphragm or pupil—so as to contract the aperture and cut down the offending intensity. The curious fact comes into action that the brilliancy of the image thrown on the retina by any light source is constant at all ordinary distances in air from the source, for a given iris aperture. That is, if an eye is made to face any bright body, such as a flame, then when the iris aperture is kept constant, the size of the image thrown by the flame on the retina at the back of the eye will dwindle as the eye retreats from the flame; but the intensity of illumination in the image will remain constant at all distances. At a great distance the image may occupy, say, 1 sq. mm of retinal surface, with perhaps 1 microlumen per sq. mm and 1 microlumen total flux in the image. At a short distance the image may occupy 20 sq. mm of retinal surface, with 20 microlumens of total flux in the image, but yet with the same intensity of 1 microlumen per sq. mm. A similar phenomenon is presented in the photographic camera, where the image of a flame increases in area, on the ground glass plate, as we approach the flame, but the intensity of the image in lumens per square millimeter remains constant. Now, it appears that the stimulus to the iris muscle is determined more by the maximum intensity of illumination on the retina than by the total flux of incident light. Hence a brilliant light anywhere within the field of vision, even though a long way off, tends to shut down the iris diaphragm. But shutting down the pupil reduces the light entering the eye from all parts of the field. Consequently, an illuminated page or other object which might make a good, clear picture on the retina with the diaphragm open may make a poor and indistinct picture with the diaphragm cut down, merely because a brilliant light source happens to strike the retina somewhere.

The economic moral of the story is that we may have powerful illumination on objects and yet very poor seeing, because a brilliant light source comes into the field of view. Naked arcs or naked tungsten filaments may so haunt the field of an observer's view that, turn where he may, his pupil has to keep contracted and so keep all the rest of the visual field dim. Half of the flux of light poured into the same room, from lamps in the same places but of lowered brilliancy, might give him possibly twice as good seeing, because his pupil would have a chance to dilate and let the light into the retina. Thus, to produce interior lighting from brilliant sources in the field of view may be very wasteful, optically and physiologically.

The only efficient way, therefore, to use brilliant light sources is to hide their brilliancy from view. This can be done in any one of three ways. One is to hang the sources where they will not occupy the visual field. Brilliant lamps high in a room may not be within the field of view under normal conditions. A second way is to conceal the lamps behind reflecting or diffusing screens, such as ceiling cornices, and thereby produce indirect lighting. The third way is to hang the lamps where one chooses but to reduce their brilliancy by increasing their active surfaces; this may be done by inclosing the lamps in diffusing bulbs, chambers or globes. The eye can then rest on the enlarged secondary source without having the iris muscle stimulated. The practical advantage of diffusing globes is thus evident.

In an article in this issue Mr. M. Luckiesh discusses the diffusing and absorbing powers of certain types of glassware. What is ideally desirable is complete diffusion, together with negligible absorption. In other words, each little surface element of the inclosing globe receiving its share of light from within should emit all of that light, scattering it in all directions, as though the element were an original source. In practice it absorbs an appreciable amount and does not scatter the remainder properly. Thin globes of a suitably diffusing material are naturally less likely to absorb than are thick ones, other things being equal. The data reported are of much practical interest.

Further Work on the X-Rays

As we have recently had occasion to note, the researches of the last few months on the reflection of X-rays from crystal surfaces and their transmission through crystal bodies have gone far toward clearing up the mystery of their character. All these investigations have pointed to the X-rays being similar in character to other electromagnetic radiations but of enormously shorter wave-length. Very lately some of the English investigators have gone a step further in the same direction and have found a certain tendency toward differentiation of the reflected rays into bundles forming something akin to a spectrum—a spectrum differing in the case of the so-called "hard" and "soft" tubes. It is too early yet to receive confirmation of this announcement beyond the original report. Previous experiments have shown the reflected X-ray to be fairly homogeneous. If the present indications are borne out so that by suitable means the heterogeneous radiations from X-ray tubes can be separated, a long step will have been taken toward the investigation of a region among the extremely short wave-lengths heretofore completely out of reach. More than this, a new clew to the mystery of atomic and subatomic structure will have been disclosed, a clew that may lead further than we now dream.

The News of the Week

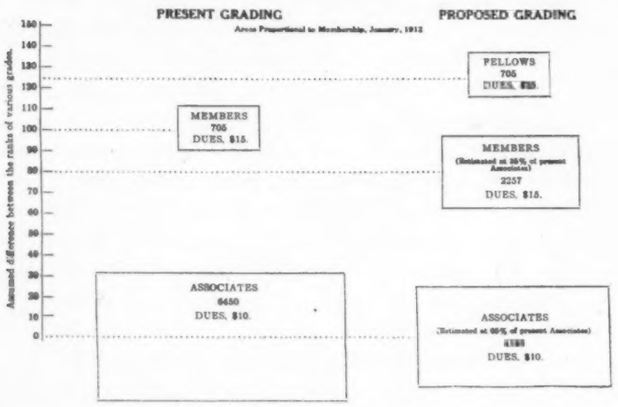
Activities and Events in the Electrical Field—Reports of Meetings—Commission Findings, Etc.

Lawsuit Against the A. I. E. E.

On Thursday of the present week in the Supreme Court of the State of New York a suit was brought against the American Institute of Electrical Engineers, its president and the board of directors, in the name of Dr. Louis Duncan, Prof. Francis B. Crocker and Prof. Michael I. Pupin, to restrain the defendants from "transferring or electing any person to the grade of Fellow or Member without fairly considering and deciding on merit whether such person has the qualifications required by the constitution." The plaintiffs claim that the transfer under the special section is "contrary to the provisions and requirements of the constitution and by-laws of the defendant American Institute of Electrical Engineers and is illegal."

In view of the attention to Institute affairs which this suit has attracted, an outline of the conditions leading to the amendment of the constitution and the introduction of the "special section" should prove of interest.

In this connection it is worthy of note that the amend-



DIVISION OF MEMBERSHIP

ments referred to received the record vote of 45 per cent of the membership, of which 83 per cent voted in favor of the proposed changes.

The amendments, including the special section, were the result of the work of an Institute committee appointed in 1911 to propose a plan for an additional grade of membership. There had always been in the Institute only two grades, Associate and Member, the latter or full professional grade being jealously guarded and so exclusive as to include less than 10 per cent of the membership. The grade of Associate was composed of two classes—junior professional electrical engineers and a large number of friends of the profession, commercial or financial members, or laymen, who were, nevertheless, sufficiently interested in scientific and engineering matters, and in electrical engineering in particular, to desire to support the objects for which the American Institute of Electrical Engineers was established and to be interested in its transactions.

The desire for an additional grade of membership which would permit the separation of the professional and non-professional elements among the Associates had been so long expressed that for four years successive committees had been appointed to study how best this important constructive change could be made in the Institute's organization. The present plan was first approved by a unanimous vote of the board of directors and then by the largest constitutional vote of the membership ever recorded in the history of the Institute, indicating that the plan proposed met, to an unusual degree, the desires of the membership. Approximately stated, this plan consisted, in brief, of increasing from five to ten years the experience required for the highest grade, calling that highest grade by the name of Fellow and transferring to it as the nucleus with which to start practically all of the members of the old highest grade. The name of Member, no longer used for the highest grade, was kept for the intermediate grade, and the standard was somewhat reduced. The grade of Associate remained unchanged. Transfers from one grade to another were provided for in the customary manner of application, examination by the board of examiners and vote of the board of directors, two negative votes excluding an applicant.

To get this new plan promptly started, it was recognized that some special provisions must be adopted for temporary application at the outset, and the special section, valid only until May 1, 1913, was enacted. This gave to members of record at the time the amendments were adopted the right to transfer on complying with certain special conditions. It was believed that the board of examiners could not discharge the duty of investigating the records of the several thousand members who would apply at the outset for transfer from Member to Fellow and from Associate to Member. Since it was decided, as a matter of policy, and in accordance with previous custom in the Institute and in other societies, that the increased standard of the highest grade should be accomplished gradually, because it was felt that it would be an injustice to old and distinguished members of the Institute to exclude them from the highest grade when the standard of the grade they were in was to be lowered, it was considered wise to arrange a plan that would not make too onerous the transfer of older members to the grade of Fellow.

If five Members or Fellows, upon inquiry, certified that a Member met the requirements for Fellow in the constitution, he had the right to be transferred and, correspondingly, if four Members or Fellows, upon inquiry, certified that an associate met the requirements for Member in the constitution, he had the right to be transferred to that grade.

The contention of the plaintiffs in the present suit is that the certification alone is not sufficient, and that in addition to it the applicant's name should go before the board of examiners for the investigation of his professional record, and that instead of the applicant having a right to transfer, he can be rejected by two negative votes in the board of directors, and that unless this interpretation be followed, the integrity of the two higher grades in the Institute cannot be preserved.

The contention of the defendants is that, since it was decided as a matter of procedure that the increase in standard of the highest grade should be gradual by applying the severer requirements only to new entrants, the transfer of practically all of the old grade of Member into the new grade of Fellow was the only just course to pursue, and if there were already in the grade of Member persons whom the mistakes of previous boards of examiners had wrongfully admitted there, their transfer to Fellow could

not be avoided. It was felt that, as their number was extremely small, a broad constructive addition to Institute organization should not be hampered by this consideration.

In respect to transfers from Associate to Member, the reduction of the standard of the grade of Member and the fact that the grade of Member was no longer the highest grade in the Institute made rigorous examination less necessary than it otherwise would have been, but, nevertheless, it was felt that those holding the rank of Member or Fellow in the Institute would be sufficiently honorable and conscientious and sufficiently jealous of the standards of those grades not to certify that an applicant from the grade of Associate met those standards unless he really did, especially when what was required of the four Members or Fellows who acted as certifiers or, in fact, as a board of examiners was not the mere giving of their opinion, but a "certification" of the facts of the applicant's career.

The defendants claim that when an applicant has been certified by the group of four or five Members or Fellows respectively, provided for by the constitution under the special section, he has complied with the requirements of the constitution, and the board of directors is then constitutionally obliged to transfer him, its only discretion being the making sure that he has in fact been duly certified by the requisite number of men who are in fact Members or Fellows in good standing.

In the accompanying illustration is reproduced a diagram which was sent to each member of the Institute at the time the proposed amendments were to be voted upon. At that time it was estimated that 705 members would be transferred to the grade of Fellow and that about 2257 would enter the grade of Member. Up to the present month there have been transferred under the special section 308 to the grade of Fellow and 389 to that of Member.

Reduction in Tungsten-Lamp Prices Foreshadows Free Renewals

The manufacturers of tungsten incandescent lamps have decided on a further reduction in the price of lamps which will become effective about July 1. Although the exact prices cannot be ascertained as we go to press, there is every reason to believe that the cut will be at least 10 per cent. In view of the concerted movement among the large Edison companies to devise some plan whereby tungsten lamps can be placed on a free-renewal basis just as is the present graphitized-filament lamp, it is more than probable that following this reduction in the prices of lamps will be the announcement that the Edison companies have placed tungsten lamps of the larger candle-power ratings on a free-renewal basis. Certainly the lamp committees of the national associations are working hard toward that end.

Operating Staff of Toronto's Municipal System Out

Most of the feature space in the six daily newspapers of Toronto, Ont., has been occupied during the past week with charges, counter-charges, rumors and statements affecting the turbulent situation brought to a head by the petition presented to the Mayor against Commissioner Ellis by Acting Manager W. R. Sweany of the Toronto Hydro-Electric System, which culminated in the dismissal of Mr. Sweany and the resignation of the chief engineer, general superintendent, engineer of distribution, engineer of operation, superintendent of meter department, chief inspector, manager of appliance department, sales manager, contract agent and the assistant to the acting general manager. The events leading up to the final break are in brief as follows:

Last summer Mr. H. L. Drayton, the commissioner representing the Ontario Hydro-Electric Commission on the board of the Toronto Hydro-Electric System, was appointed to the chairmanship of the Dominion Railway Board. Mayor Geary, who, under the law, was an ex-officio member of the board of the Toronto Hydro-Electric System, and who was familiar with the work from the construction period, resigned the mayoralty and was appointed Corporation Counsel of Toronto. The new Mayor, Mr. H. C. Hocken, who became an ex-officio member of the Toronto board, was entirely unfamiliar with the situation so that the work of the commission was left practically in the hands of one commissioner, Mr. P. W. Ellis, who had been appointed by the City Council of Toronto on the original Toronto Hydro-Electric System board.

When the original manager of the Toronto Hydro-Electric System, Mr. Kenneth L. Aitken received leave of absence owing to illness last fall, his assistant, Mr. W. R. Sweany, was appointed acting manager and immediately took charge of the construction of a distributing system, including the street-lighting system, poles and lamps, and organized the sales and operating departments.

A short time after active operations began, Mr. Sweany is said to have experienced difficulty in securing cost figures from the accounting department, which, it is claimed, had been manned by appointees of Commissioner Ellis. When attention was called to the matter, it is claimed that the manager was told in effect that the question of costs did not concern him. This was the beginning of friction between the various departments, and before long the situation grew to be such that there was a distinct lack of confidence between the commissioner and the operating staff. A little over a week ago Mr. Sweany petitioned the Mayor to use his influence with the City Council not to re-appoint Commissioner Ellis, whose term as commissioner had just expired. Mayor Hocken gave Mr. Sweany's letter to him to the daily press, and its publication created a sensation. Commissioner Ellis forthwith dismissed Mr. Sweany from his position as acting manager and thereupon ten heads of departments who had signed the petition handed in their resignations.

Upon Mr. Sweany's dismissal Mr. R. A. Ross, consulting engineer of the Ontario Hydro-Electric Commission, was called in as acting manager of the Toronto Hydro-Electric System, and Mr. R. G. Black, formerly superintendent of the Toronto Electric Light Company, Ltd., was appointed as his representative and assistant.

Ice Protection Against Flood Water at Louisville

During the flood at Louisville, Ky., the water rose considerably above the windows and doors of the Fetter generating station, now under the control of Gen. George H. Harries, of H. M. Byllesby & Company. Floods, however, are not uncommon in Louisville, although that of this year was unsurpassed as regards volume except by the famous flood of 1884. Hence the engineers of the power station were prepared to conbat emergencies of the kind and adopted an ingenious method of making the doors and windows watertight and of preventing the power station from floating away because of its buoyancy when surrounded by water. A part of the equipment of the power station is an ice-manufacturing plan, and as the water rose in the streets refrigerating coils connected with this plant were laid around the edges of the windows and doors, the chinks of which were filled with sawdust. After the sawdust became saturated with water it was frozen by means of the refrigerating coils and thus the inflow of water was prevented. To counteract the tendency of the station building to rise when immersed in the flood waters, some water was permitted to run into the basement as "ballast." During the flood communication with dry land was maintained by a number of rowboats moored to the chimneys.

Competitive Conditions in Macon, Ga.

The granting of a franchise to the Georgia Public Service Corporation of Macon, Ga., to manufacture and distribute gas in that city will add zest to the fight between that company and the Macon Railway & Light Company. The latter company is one of the properties of A. B. Leach & Company, bankers, of New York, who purchased it, together with the Central Georgia Power Company, from Mr. W. J. Massee, at that time president of both companies. Shortly after the deal was consummated the Georgia Public Service Corporation was formed with the former president of the Macon Railway & Light Company at its head, and it obtained a franchise to generate and distribute electricity in Macon. The latter company has just placed in operation a steam-turbine station containing one 1500-kw and one 500-kw Allis-Chalmers unit. Coincident with the starting of the station came a cut in rates and a fight for business.

The city lighting contract for 400 4-amp magnetite-arc lamps was taken by the Macon Railway & Light Company at the rate of $21.95 a lamp per annum on a five-year basis and the rate for commercial and residence service was cut in two. The net rate for commercial lighting is as low as 2 cents and for residence lighting 6 cents, the minimum charge in each case being $1 and 50 cents per month respectively. The gas rate is $1.25 per 1000 cu. ft., and it is this branch of the company's business which is now attacked.

The Railroad Commission of Georgia, which has supervision over the public utilities of the State, has never taken a definite stand on the matter of competition, its policy heretofore being rather to encourage than discourage it. By its ruling, however, companies are prevented from raising rates once lowered without its consent, as per the following extract from its general order No. 14, dated Dec. 23, 1909: "All rates now in effect, or which may hereafter become effective, which are not higher than the maximum rates prescribed by this commission, whether such rates are the result of voluntary action upon the part of any company, corporation or person, subject to the jurisdiction of this commission or otherwise, are hereby established as the rates of the Railroad Commission of Georgia, and no such rates shall be discontinued or raised without the consent of the Railroad Commission first being obtained, but all such rates shall continue in force without hindrance, the same as other rates prescribed by the commission."

The Macon Railway & Light Company, however, has not changed its base rate, the low rates being made possible by reason of discounts allowed. It is more than likely that an attempt will be made to end competitive conditions as quickly as possible, so that a further reduction may be made effective. It is considered improbable that the ruling of the commission can be enforced in the case under consideration, especially if the company can prove that consumers are being served at a loss.

Plans of the Society for Electrical Development, Inc.

In order to further the work of the Society for Electrical Development, Inc., several of its committees are to hold meetings in May at the society's offices, Engineering Societies Building, New York.

On May 5 the slogan committee, which is composed of Messrs. J. Robert Crouse, Philip S. Dodd, J. M. Wakeman and George Williams, will hold a meeting. Over 500 suggestions have been received by the society as a result of the contest it announced a short time ago for a suitable trademark and "slogan" to be used by it in the various campaigns to extend the use of electricity. These suggestions will be considered by the slogan committee in order to select the one best adapted for the society's purpose.

A special committee on plans has been appointed to study the mass of suggestions and ideas produced at the conference of the society in New York on March 4 and 5. This committee, a list of whose members appears below, is composed of men especially qualified to pass upon the different phases of effort contemplated by the society. The specific purpose of this special committee is to prepare from the many plans and suggestions made at the conference a comprehensive plan to be submitted to the members of the society at their annual meeting, which will probably be held in Chicago just prior to the annual convention of the National Electric Light Association. The plans of the society will be presented to the industry at large in a booklet to be issued shortly after the meeting.

According to the by-laws, the first regular annual meeting of the society is scheduled to be held at its offices at 11:30 a. m. on May 13, but as the annual meeting of the National Electric Light Association is to be held in Chicago June 2-6, the board of directors of the Society for Electrical Development, Inc., states that no business will be conducted at the meeting held in New York on May 13, and that this meeting will be adjourned to reconvene in Chicago at 11:30 a. m. on May 31, in the special meeting room of the Hotel Sherman.

The members of the committee on plans are as follows:

From the central-station companies—Messrs. E. W. Lloyd, L. D. Gibbs, Arthur Williams, George Williams and M. E. Turner.

Contractors—Messrs. H. B. Woodhill, C. L. Eidlitz, C. R. Krieder and W. D. Carstophen.

Jobbers—Messrs. Gilbert Smith, C. C. Sibley and P. L. Thompson and Col. A. V. Carter.

Manufacturers—Messrs. F. H. Gale, J. C. McQuiston, H. I. Markham, Kern Dodge and J. Robert Crouse.

At Large—Messrs. F. B. Rae, Hugh M. Wilson, F. E. Watts and T. C. Martin.

New York to Determine Economy of Isolated-Plant and Central-Station Service for Municipal Buildings

A test which is to run continuously for an entire year is being conducted upon the steam and electrical generating plants in the Hall of Records in New York City. The building in question is located directly opposite the new Municipal Building, which has central-station service, and just north of City Hall Park. It contains an electrical generating plant comprising four units, with an aggregate rating of 450 kw, and the boiler equipment comprises five water-tube boilers, with a combined rating of 1600 hp. A complete description of the installation is contained in the *Electrical World* for July 27, 1907. From the completion of the Hall of Records until the autumn of 1912 the electrical generating plant supplied the requirements of this building alone, and the installation was considerably in excess of the maximum demand to which the plant was subjected. Last fall the City Hall, the City Court and the County Court Buildings—all of which are located in City Hall Park—were connected with the Hall of Records by means of underground ducts and steam mains, and since that time the three buildings in City Hall Park have secured electricity for lighting and motor service and steam for heating from the plant in the Hall of Records.

While the Bureau of Municipal Research had collected data upon certain buildings in New York City, which purported to show the comparative cost of supplying these buildings with light, heat and motor service with electrical energy purchased from the central station and with electrical energy generated upon the premises, the bureau was unable to reach a decision as to whether any real economy would result from supplying the buildings in City Hall Park from the Hall of Records plant. It was decided that

the only way to settle this question would be to make a year's test, and such a test was sanctioned by the Borough President upon the advice of the Bureau of Municipal Research.

The test is being conducted by a board of supervising engineers, consisting of Mr. E. P. Goodrich, consulting engineer to the Commissioner of Public Works; Prof. George F. Sever, consulting engineer of the Department of Water Supply, Gas and Electricity; Prof. Charles E. Lucke, of Columbia University; Prof. R. C. Carpenter, of Cornell University; Mr. R. P. Bolton, of New York City, and Mr. E. F. Tweedy, of the New York Edison Company. Prof. Herman Diederichs, of Cornell University, is in direct charge of the test.

Bond Issue for Los Angeles Municipal Distribution System Defeated

The bond election held in Los Angeles, Cal., on April 15 for the installation of a municipal electric distribution system costing approximately $6,500,000 resulted in the defeat of the issue.

For the past six years the city of Los Angeles has been working upon an aqueduct to bring the waters from Owens River to the city, a distance of approximately 250 miles. The capacity of the aqueduct is 20,000 miners' inches, and the estimated cost of the enterprise is $23,000,000. It is expected that the aqueduct construction will be completed during the latter part of the present year, and water drained from the high Sierras by the Owens River will be available for use in the city of Los Angeles within six months' time.

In connection with the aqueduct construction a considerable amount of electrical energy can be developed by the installation of plants at various favorable locations along the route. The maximum amount possible to generate is variously estimated from 60,000 hp to 65,000 hp with greater outputs over the peak by means of storage reservoirs. Three years ago a bond issue of $3,500,000 was authorized by the citizens for the installation of the first generating plant at a site in the San Francisquito Canyon, relatively close to Los Angeles. This plant is constructed to develop an average of 17,500 hp and over the peak a maximum of 35,000 hp. The original estimated cost of $3,500,000 will be exceeded by $1,350,000.

Propositions Made by Existing Utilities

There are three generating and transmission companies doing business in Los Angeles—namely, the Pacific Light & Power Corporation, the Southern California Edison Company and the Los Angeles Gas & Electric Corporation. The two first-named companies distribute a large amount of energy outside Los Angeles as well as inside the city, and the last-named company confines its electrical operations entirely within the limits of the city of Los Angeles. Naturally there has been much anxiety among the city officials and the officers of the generating companies as to how the city's electrical energy, to be generated along the aqueduct, should be distributed. During the past two years frequent meetings and discussions have been held between the city's representatives and the representatives of the interested central-station companies, and at an early stage it developed that whereas the latter were willing to take the aqueduct energy from the city upon a fair basis and distribute it over their own lines, the city officials were mostly of the opinion that the city should purchase such portions of the existing distributing systems as it might desire and distribute the aqueduct energy itself. Finally the generating companies were asked to set prices on their distribution systems in Los Angeles. This, because of the restrictions in the trust deeds securing the various bond issues on their properties, the companies were unable to do, and this condition was explained to the city officials. The latter, however, would not accept the explanations as sufficient.

It has been recognized by the heads of the three companies in question that the aqueduct energy would be cheap, because it is practically a by-product, and that the people of Los Angeles should have the full advantage of it. Many believed that if a proper agreement were made between the city and the companies the city could sell its electrical energy at wholesale, and the citizens could have it distributed to their doors by means of existing lines at as low a cost as the city could do itself, for the Mayor and Council could fix the price at which the energy would be wholesaled to the companies, and the Board of Public Utilities, appointed by the Council, would fix the schedules at which the energy would be disposed of to the consumers in the city.

Finally, the companies made the following four definite and distinct proposals to the Los Angeles City Council: (1) To purchase the aqueduct energy at a fair price—from $750,000 per year upward—according to the amount developed. (2) To become the distributing agents for the city, the price for this service to be determined upon the basis of the amount of energy distributed, the city to deal directly with the consumers in all matters pertaining to the service. (3) To lease the present distributing systems to the city upon a satisfactory basis to be agreed upon. (4) To handle the aqueduct energy on a partnership basis.

The present city administration of Los Angeles, however, contended that the companies must sell their lines and get out of the city or the city would put in its own distributing system. The City Council would not submit the proposals made by the companies to the people but decided to call a bond election and submit to the citizens the question whether or not the city should bond itself for $6,500,000 to put in an electrical distribution system which would parallel existing lines. After several postponements it was decided to hold the election April 15, and at the same time bonds, mostly for other aqueduct matters, were to be submitted, the total amount under consideration being $17,600,000.

Movement to Oppose Bond Issue

The majority of the business men of Los Angeles were plainly against the issue of power bonds for $6,500,000, believing that the expenditure was not necessary at the present time, if at all. A voters' Educational Association was formed, with the idea of investigating the merits of each of the eight bond issues to be considered by the taxpayers and to make recommendations to voters. At a meeting held Jan. 23, 1913, resolutions were adopted indorsing only two of the eight proposals.

With regard to the proposal for $6,500,000 of bonds for an electric distributing system, the Educational Association's recommendation was as follows: "While it seems to be the consensus of opinion that it will be wise to use the electrical energy generated along the line of the aqueduct to furnish light and power to the people, with the opportunities offered through the proposals of the generating companies to lease the energy from the city at a rental that will at once materially reduce the burden of taxation, and with the right vested in the Council to fix the rates which the companies are allowed to charge, thereby offering ample protection to the consumer and all the advantages that would accrue if the city distributed the energy itself, and without any burden, or by the acceptance of the proposal of the companies to lease to the city the present distributing systems of the companies, the voting of such a large amount of bonds for this purpose is not necessary at this time and can and should be deferred." In the resolution which followed citizens were advised "to vote against the $6,500,000 bonds for the construction of a lighting distributing system."

Educational Campaign of Electric Companies

The electric companies did not commence a campaign of education until about three weeks before the date finally fixed for the election. In Los Angeles there are three morning papers and two evening papers. Two of the morning papers were opposed to the power bonds, but not actively; one morning paper was aggressively in favor of the bonds; both evening papers were in favor of the bonds and were somewhat bitter against the lighting companies. In the three morning papers and one evening paper daily electric talks were published, paid for by the companies, and these were of undoubted value from an educational standpoint. Other literature was published and mailed to voters, pointing out certain conditions surrounding the issue before the people. One of the companies mailed to each of its 45,000 customers in Los Angeles a letter containing a straightforward statement of the whole matter, in as few words as possible. Many consumers took the trouble to send replies to the effect that they agreed with the company's stand and that they would use their influence to oppose the approval of the bonds. The letter read as follows:

"To Our Consumers: A bond election is to be held in Los Angeles on Tuesday next, April 15, and one of the things to be considered is whether or not the city will expend the sum of $6,500,000 for an electric distribution system.

"The Southern California Edison Company has always been frank and fair with its customers and has consistently endeavored to be worthy of their confidence. The company is not in politics and has no desire to enter that field. But this bond election is of great importance to the city, to the company and to you as taxpayers, and for this reason we now give you some undeniable facts, which you are asked to consider.

"1. The electric companies now supplying Los Angeles have a combined distribution system which amply takes care of all parts of the city. The proposed bond issue for a distributing system is not sufficient to supply more than two-thirds of the city's present needs.

"2. The electric companies have made four definite proposals to take all the energy generated on the aqueduct as soon as it is ready for delivery, viz: (a) To purchase the energy at a fair price; (b) to become the distributing agents of the city; (c) to lease the existing distributing system to the city; (d) to handle the aqueduct electricity on a partnership basis. The acceptance by the city of any one of the above proposals means that the city would immediately receive a large income, available for the reduction of expenses.

"3. You are aware that taxes are high in Los Angeles. The proportion of the tax levy at present applicable to interest on bonds and sinking fund is 64 cents on $100. If the additional power bonds of $6,500,000 are voted, the rate will be raised to 75 cents on $100. But if these bonds are defeated and any one of the offers made by the electric companies is accepted, the large income made available from the sale of energy will be equivalent to a reduction of the present rate from 64 cents to 45 cents on $100. In other words, the difference to you as taxpayers by defeating the power bonds will be 30 cents on $100.

"An argument has been put forth that voting these bonds would place the city in position to reduce rates for electric service, granting two years for the installation of the system and development of the business. Owing to the continued growth of Los Angeles the city administration makes some reduction in rates almost every year, and these reductions seem likely to continue under present conditions.

"4. By defeating the power bonds you will prevent your streets from being encumbered with two lines of poles where one line is sufficient.

"Vote against the proposed power bond issue of $6,500,000 and reduce your taxes. Then combine aqueduct energy and the companies' distributing systems and make reduced rates a certainty. Remember the city is in a position to regulate the wholesale price it shall receive for the aqueduct energy and also the price at which it shall be resold to the consumers, and any arrangement along the lines we have suggested need not necessarily be permanent, but it is well worth trying for a few years."

The effectiveness of the campaign, which was conducted by the companies along frank and clean educational lines, may be judged by the result. Under the city charter a two-thirds vote is necessary to approve bond issues. A total vote of approximately 52,000 was cast in connection with the power bonds, and the movement was defeated by about 4000 votes.

Commercial Section Features at the Chicago Convention

At the meeting of the executive committee of the Commercial Section of the National Electric Light Association held at the Hotel Sherman in Chicago last week several matters of importance were discussed and the program for the convention was finally passed on. In addition to reports from the standing committees on finance, publications and membership, printed reports will be made by the following committees: Electrical salesman handbook, Mr. E. L. Callahan, Chicago, chairman; electricity on the farm, Middle States, Mr. C. W. Pen Dell, Chicago, chairman; Eastern States, Mr. J. C. Parker, Rochester, chairman; wiring of existing buildings, Mr. R. S. Hale, Boston, chairman; ice and refrigeration, Mr. G. H. Jones, Chicago, chairman; electrical merchandising, Mr. T. I. Jones, Brooklyn, chairman; steam heating, Mr. S. M. Bushnell, Chicago, chairman; advertising, Mr. J. R. Crouse, Cleveland, chairman; education of salesmen, Mr. George Williams, New York, chairman, and short cuts in executing customers' orders, Mr. G. C. Holberton, San Francisco, chairman. Additional features will be a lecture by Mr. M. Luckiesh, of Cleveland, on "Light and Art" and a talk by a prominent citizen of Chicago. Headquarters of the Commercial Section at the convention will be established in one of the exhibit spaces in the basement showroom of Medinah Temple.

N. E. L. A. BUTTON FOR COMMERCIAL SECTION

A distinctive N. E. L. A. button has been designed for members of the Commercial Section as shown herewith, the ring shown in black in the engraving being blue, the lettering gold and the rest of the button white. There will probably be four sessions of the Commercial Section, and these will be held in a large tent with ground dimensions of 50 ft. by 85 ft. erected on the lawn west of the Temple building. This tent will seat approximately 700. It is expected that the attendance at the Commercial Section sessions will be so large that room can be provided only by this means. The general assembly room of the Temple will be in use for the general sessions of the convention, and there are no other quarters in the Temple considered large enough to accommodate the expected attendance.

Activity of the Jovians

The present administration of the Jovian Order with Mr. Frank E. Watts, of New York, as Jupiter and Mr. Ell C. Bennett, of St. Louis, as Mercury, is a very active and energetic one. From Oct. 16, 1912, to April 1, 1913, 1590 new members were initiated into the order, which passed

the 10,000 mark on March 29. However, even this rate of progress does not satisfy the energetic officers, and they are urging the necessity for extra efforts during the month of May. Future rejuvenations now definitely set at this writing, with names of the statesmen in charge, are as follows: April 29, Pittsfield, Mass., Mr. E. F. Gehrkens; May 8, Oklahoma City, Mr. W. J. Laufenburgh; May 9, Austin, Tex., Mr. A. E. Hancock; May 22, Galveston, Tex., Messrs. A. J. Binns, P. Loyd Lewis and Charles L. Martin; May 23, St. Louis, Mr. F. D. Beardslee; May 24, Erie, Pa., Mr. R. B. McClain; June 3, Chicago, Mr. George C. Richards; June 4, Louisville, Mr. C. A. Klemm; June 7, Pittsburgh, Mr. M. Frank Knapp; June 17, Cedar Point, Ohio, Messrs. A. E. Loeb and M. H. Moffett.

Convention of Missouri Electric Association at Kansas City

Mr. J. E. Horsh, business manager of the City Light & Traction Company of Sedalia, Mo., and vice-president of the Missouri Electric, Gas, Street Railway and Water Works Association, presided at the seventh annual convention of this association, held in the Coates House at Kansas City, Mo., on April 17, 18 and 19. In his address Mr. Horsh spoke in very complimentary terms of the services rendered the association by Mr. P. A. Bertrand, the past-president, who resigned previous to the meeting of the executive committee at St. Louis in January. Mr. Bertrand, it was stated, resigned because he felt that he had severed his connection with the association when he left the Jefferson City Light, Heat & Power Company, of which he was manager, to go to another State.

Thorough organization of the Missouri association was recommended in the vice-president's address, with a view toward developing every phase of industry represented by its name. Special efforts will be made to cover the subjects of gas and water-works, as many of the members are interested in combination properties. With this idea in view a committee consisting of Messrs. Herman Spoehrer of St. Louis, F. E. Murray of Louisiana, Mo., and R. J. Irvine of Moberly, Mo., was appointed to prepare a program for the 1914 convention covering all subjects closely allied with the industries in which the members are interested. Interest in electrical subjects will not have to be fostered, as was evident from the program. More attention will be directed toward practical topics of interest to small stations at future conventions, and special stress will be laid on rates, policies and labor costs. Committees will be appointed to keep in close touch with all state and municipal matters concerning public utilities. The hope was expressed that this association would become closely affiliated with the National Electric Light Association.

Two papers, which were prepared by Mr. J. A. Gelzer, of the Wagner Electric Company, and Prof. L. E. Hildebrand, dean of engineering at the University of Missouri, respectively, were read at the afternoon session on the first day of the convention.

Single-Phase Motors

Mr. F. Johnson, of the Wagner Electric Manufacturing Company, read Mr. Gelzer's paper, which was entitled "Solving the Small Users' Problem." The paper was an exposition on the merits of single-phase motors, particularly as applied to smaller installations. Figures were given showing the saving on the original transformer and meter investment and on the transformer losses attributed to the use of single-phase instead of polyphase motors. The relative disturbing effect of single-phase versus polyphase motors on transmission lines was discussed, and the effect on the power factor was noted.

In the discussion of the paper inquiries as to the performance of the unity-power-factor motor manufactured by the Wagner company were made by Messrs. R. J. Irvine and J. O. Macfarlane. The advantage of the unity-power-factor motor as a condenser on the line was questioned because of its reduced efficiency. In reply it was said that if the loss in efficiency in one case offset the gain in the other the saving in transformer investment installation and transformer losses would show in favor of the single-phase motors.

Transformer Substations

Prof. Hildebrand's paper on small transformer substations was read by Mr. R. K. McMasters. This paper outlined a means whereby isolated industries and towns along high-tension transmission lines can be supplied with energy with profit to the central-station company. Accompanying the paper were curves plotted to show the initial investment and the operating expenses connected with the installation of step-down distributing substations for communities consuming different amounts of energy. Indoor and outdoor type substations designed for manual and remote control were represented by different curves. By the aid of these curves a method was shown which enables an equitable charge per kilowatt-hour to be determined for different communities.

From the figures given, it appears that the standard indoor step-down substation is entirely too expensive an installation for supplying energy to isolated consumers whose aggregate consumption is 300 kva or less. A 100-kva outdoor substation can successfully compete with a 400-kva indoor station in producing returns to the central station.

Several representatives of companies supplying energy throughout rural districts in Missouri took part in the discussion. Mr. P. W. Markham, superintendent of the Brookfield Electric Light Company, spoke of some very promising rural districts in Missouri which are rapidly being supplied with electricity from the company's lines.

Mr. Paige, of the General Electric Company, described the new portable step-down substations which are being used in connecting rural distribution lines with high-tension transmission lines in which the potential reaches 70,000 volts.

White River Development

The morning session on April 18 was opened by an illustrated lecture on the "Hydroelectric Development on White River" by Mr. T. O. Kennedy, of the White River Construction Company. An abstract of this paper will be given in a subsequent issue.

Manufacturing Operations

Mr. F. B. Uhrig, of the Western Electric Company, gave an illustrated lecture on the conversion of the raw material to the finished product. Stereopticon views of scenic rides through Utah and the copper mines at Bingham, Utah, together with exterior and interior views of the Western Electric Company's buildings at Chicago, accompanied the lecture. A few figures on the cost of mining copper and the expenses connected with the Western Electric factory at Chicago were given.

Convention in 1914

At the executive session held in the afternoon a committee consisting of Messrs. S. Spoehrer, C. R. Croninger and J. R. Woodfill, Jr., reported on the meeting place for the 1914 convention. A round trip from St. Louis to Keokuk by boat in the early part of May was suggested. The Mississippi River Power Company has invited the association to inspect the plant at that time. The trip will extend over three days, so that the scenery passed in the night on the voyage up the river will be viewed in daylight on the return. Business will be conducted on the boat. May 7, 8 and 9 were set as the date for the convention, subsequent to change to avoid conflict with other conventions. The session adjourned early in order that all of the mem-

bers attending might take advantage of the automobile trip around the scenic Cliff Drive and other boulevards of Kansas City.

Banquet

In the evening a banquet was held at the Coates House, at which several members of the senatorial committee on conservation of water-powers and of the state utility commission were guests. Mr. William Hand was toastmaster. Mayor Jost of Kansas City expressed his views on municipal and corporate ownership of public utilities. Although he does not believe in municipal ownership of public utilities in general, he does believe that such utilities should be put in charge of the city when a corporation takes advantage of the citizens. Senator Bronson and Senator Hawkins each gave a short informal talk.

Electricity in Agriculture

Mr. E. P. Edwards, of the General Electric Company, gave an interesting talk on electricity as a factor in progressive agriculture. In speaking of the investment and expenses connected with the operation of various farm machines, he said that he believed it was the duty of agricultural schools and the United States Department of Agriculture to establish a bureau which would compile data on the cheapest methods of operating apparatus used on farms. Only in this way does he believe that farmers will promptly accept electricity as their motive power.

In the absence of such data, the General Electric Company has conducted tests on numerous farm machines, the results of which show the advantage of electricity over other motive powers. Comparative tests for determining the relative costs of manual labor, work done by horses and electric motors show that for manual labor the cost is 88 cents per hp-hr., for work done by horses 8 cents per hp-hr., and for electrical service 5 cents per hp-hr. It is estimated that an installation of 15 hp in motors will do the work on an average farm. A saving of from 3 to 5 cents can be realized per bushel of grain if electrically operated machinery is used.

In the interesting discussion which followed the presentation of this paper Messrs. Howard, Horsh, Lee, Henderson, Horan, Forest, Long and Woodfill took part. The prevailing opinion seemed to be that while it does not pay to install a single 15-hp motor on a transmission line, several such installations in a group would prove profitable. It was suggested that a demonstrating farm equipped throughout with electrical apparatus be established near the central station yet not too far to be out of visiting distance for prospective farmers. Electric lamps on farms are not found a profitable load to the central station unless accompanied by a motor load.

Mr. Lynton T. Block explained the relations of the Utilities Indemnity Exchange with public utilities in eliminating the profit made by old-line insurance companies. Several members of the convention commended the exchange as a result of the prompt settlements made on different occasions.

As a result of the talk by Mr. Block the following resolution was brought before the association and adopted: "Resolved, That this association recommend to its members that they join the Utilities Indemnity Exchange and thus obtain for themselves and afford to others the benefits of co-operation in the matter of liability protection."

New Officers

Reports submitted by the committee on resolutions and nominations were accepted, and Messrs. J. E. Harsh of Sedalia, Mo.; C. L. Clary of Sikeston, Mo., and F. D. Beardslee of St. Louis were elected as president, first vice-president and secretary-treasurer respectively.

Mr. J. E. Horsh, president-elect of the Missouri Electric, Gas, Street Railway and Waterworks Association, displayed, when Mr. Bertrand resigned in January, his wide-awake attitude and ability to put the association on a par with any similar association in the country. The substance of his address as presiding officer at the Kansas City convention is illustrative of his progressive qualities.

In 1904 Mr. Horsh was employed by the Denver Gas & Electric Company as meter man. He remained in the employ of this company for several years, being promoted to the business department. From 1908 until December, 1912, he occupied the position of contract agent with the Empire District Electric Company at Joplin, Mo. Since that time he has been employed as new-business manager of the City Light & Traction Company at Sedalia, Mo. During his career he has been connected with H. L. Doherty & Company, of New York City.

Trolley Trip

The 1912 convention was brought to an enjoyable close by a trip over the 1200-volt direct-current interurban line from Kansas City to Excelsior Springs. A special car chartered for the occasion stopped at Liberty, Mo., where luncheon was served at the local hotel. After a short stop at the Springs the party returned to Kansas City.

Pittsburgh Meeting A. I. E. E.

A meeting of the American Institute of Electrical Engineers was held under the auspices of the committee on electricity in mines, in co-operation with the Pittsburgh Section, at the Fort Pitt Hotel, Pittsburgh, April 18-19. About 300 members and visitors were present. On the evening of April 18 an informal dinner was held, at which local Chairman E. L. Farrar presided, and President Ralph D. Mershon made a few remarks advocating increased activity among the local sections. A series of moving pictures, entitled "From Mine to Molder," was also shown, accompanied by an explanatory lecture.

At the opening of the session on April 18 President Ralph D. Mershon called attention to the increasing activity of the Institute and the need for larger revenue. He outlined several plans which are under consideration for reducing the outlay incident to the publication of papers and proceedings. The present meeting, he said, was the first held under the auspices of the new committee, and each additional committee and new line of work taken up means greater expense. He suggested that it should be the special function of the sections, and not of the main body, to increase the membership, and thereby the revenue, of the Institute. President Mershon turned the conduct of the meeting over to Mr. George R. Wood, chairman of the committee on use of electricity in mines, who presided throughout the sessions.

The papers by Mr. H. C. Eddy on "Purchased Energy in Coal Mines" and by Mr. C. W. Beers on "Central Station Energy for Coal Mines" were then presented by the authors.

Purchased Energy in Coal Mines

This paper, by Mr. H. C. Eddy, presents a comparison between relative costs of electric energy for coal-mining purposes, as between that purchased from the central station and that generated in an isolated plant at the mine. The conditions incidental to the industry are shown to be such as to produce an exceptionally poor load-factor. The demand varies greatly within a single day and the average working time per day is less than sixteen hours. The average number of working days per month is between fifteen and twenty, and the annual load-factor is very low. Altogether there is a considerable portion of the year when the equipment necessary to an isolated-plant power source would be idle, causing the actual output to carry a very high fixed charge per kilowatt-hour generated.

The advantages which are claimed to attend the purchase of energy are summed up as reduction of fixed charges on the investment, reduction of actual operating

costs, cutting down of distribution losses, increase in output of mining machines, increased flexibility of energy supply system, reduction of labor for attendance, elimination of high maintenance and repair expense on generating equipment, cost of superintendence reduced, liability decreased, insurance against constantly increasing energy costs obtained through term contracts at fixed rates, and finally additional coal made available for sale.

Central-Station Energy for Coal Mines

After devoting some space to a preliminary study of the conditions which make desirable the purchase of central-station energy for coal-mining operations, Mr. C. W. Beers outlines the points considered in negotiating for such a supply for the Lehigh Valley Coal Company. These points were, in the order given, basis on which energy would be paid for, territory covered by contract, location of energy consumption meters, delivery voltage, power and point of delivery, maximum-demand charges, methods of denoting and rating connected load, rating of intermittent apparatus, method of determining load-factor, pole-line charges, power-factor, explanation of terms, and defining what constitutes a substation.

A contract of this kind was eventually made, and the author closes his paper with a statement of some of the ways in which the service was found advantageous to the mining operators. Among others the following seemed to carry the most weight: Promptness and reliability of service; coal that would have been used in a boiler plant at the mine was rendered available for sale; the added worry of operating a power plant was saved; a cheap and ready means for operating isolated equipment was furnished; and, finally, additions to the power equipment were more readily approved, since increased power-plant costs did not appear in the estimate.

Discussion

In the discussion of the papers Mr. George H. Morse referred to the recent law enacted in Ohio limiting the potential used in mines to 250 volts. He thought this was probably too high and that the potentials in general use throughout the mines possibly should not exceed 50 volts.

Mr. K. A. Pauly called attention to the steam and fuel consumption as brought out in the paper of Mr. Beers. Fuel is only one of the items entering into the cost of energy, and low-priced fuel is not necessarily the most economical. The steam equipment in a mine shows wear and depreciation, whereas the efficiency of an electric motor varies but slightly with age.

Mr. E. D. Dreyfus in a written communication called attention to the rapid growth of electrically equipped mines in a limited time. The author's personal observation had shown over 200 coal companies using central-station energy, and he felt this to be but a small percentage of the whole.

Mr. Partridge thought that the figure of 8 mills given by Mr. Beers might represent the cost of energy in a 1000-kw station, but he believed the lowest average figure for which energy could be sold at any profit whatever was 1.5 cents per kw-hr.

Mr. H. C. Eddy stated that in his opinion the low rate of 8 mills was possible because of the diversity-factor of the load, and his company is willing to take contracts on that basis.

Safeguarding the Use of Electricity in Mines

The dangers incidental to the use of electricity in mining work are given by Mr. H. H. Clark as accidents arising from shocks, fires and explosions. The conditions of limited working space, darkness and necessarily bare wires, quite commonly found, are such as to favor many accidents of the first-mentioned nature. Falls of roof, the blowing of fuses, sparks from trolley wheels and commutators, and even heat from incandescent lamps, may, any of them, under the right conditions, lead to mine fires. Accidents due to premature ignition of explosives by electrical means may be divided into two classes, those occurring through the action of electric currents on the explosive itself and those incident to electric action on detonators. Discussion of these factors leads up to the following suggestions for safeguarding in connection with the use of electricity in mining work: Remove contributory causes; remove from the vicinity of electrical apparatus all combustibles; confine the electricity to its proper path; where it cannot be entirely confined, use protective devices to limit its area of activity; finally, insure a high factor of safety by careful selection of material and apparatus, by installing equipment in a strictly first-class manner, by frequent and thorough inspection, and by maintaining it in good condition at all times. In closing, brief mention is made of the possibility of increasing safety by the use of portable electric miners' lamps and by operating mine locomotives from storage batteries, instead of by trolley and rail-return circuits.

Discussion

After the reading of this paper Dr. C. A. Lauffer, medical director of the Westinghouse Electric & Manufacturing Company, was asked to make some remarks on resuscitation. He explained and advocated the use of what is known as the Schaefer or prone-pressure method, stating that this was better than any mechanical method because it required no apparatus whatever.

Mr. J. S. Jenks said he instructs all his men to count three between operations in the Schaefer method of resuscitation. Each one also receives a case containing hypodermics and instructions for their use. Dr. Lauffer, however, did not approve of the use of stimulants except by a physician. At the conclusion of the discussion Dr. Lauffer gave a demonstration of the principles of first aid as exemplified by the Schaefer method, with the aid of a supposed subject who was placed on a table. Further discussion of Mr. Clark's paper was participated in by Messrs. W. E. Dickinson, Graham Bright and L. R. Palmer.

Alternating-Current Motors for Economic Operation of Mine Fans

Problems in connection with electric drive for mine fans are discussed in this paper by Mr. F. B. Crosby. The subject is divided into two main headings, constant speed and adjustable-speed drives, of which the former is passed over rapidly as of only occasional importance. Adjustable-speed drives are treated under several heads, according to the nature of the particular service requirements. The use of changeable pulleys in connection with a constant-speed motor is called a makeshift arrangement at best. Rheostatic control of a variable-speed motor is a possible method, but is not efficient and also fails to prevent excessive speed under certain conditions. The use of multi-speed windings is shown to be good in cases where two, three or four definite constant speeds will be sufficient, and this system may be used in connection with rheostatic control if desired. Where three or more constant speeds are required operation in cascade or "concatenation" may be used, and a development of this system is found in the single cascade motor. Each of the above methods has some disadvantages which limit its applicability to general problems. By use of a form of dynamic regulation these deficiencies are eliminated and shunt-speed characteristics can be obtained from a standard polyphase induction motor, with a high power-factor and high efficiency throughout the range of operating speeds. Finally, in numerous cases where adjustable-speed characteristics are desired, in place of the regulating sets mentioned in the foregoing, a brush-shifting polyphase motor may be employed to advantage. This machine may be stopped, started or reversed by proper manipulation of the brushes. The author expresses the opinion that the advantages of the polyphase motor leave small ground for the application of direct-current motors for either constant-speed or adjustable-speed fan drive.

Discussion

In the discussion, Mr. Beers said the title of the paper was misleading in that it dealt with motors. The speaker said a fan should be run at its maximum efficient peripheral speed, and that it is not a good idea to put change of speed under control of a man not directly under the superintendent. The displaced air, he maintained, should be the measure of the power to be expended. Constant-speed motors are proper for this work and the great advantages of simplicity and ruggedness possessed by the squirrel-cage motor should be capitalized. Mr. W. Sykes mentioned other schemes which he had suggested for this work and called attention to the fact that little supervision is given to a fan in the mine. The schemes proposed, he said, are of European origin and demand considerable attention. The speaker believed that two speeds will meet all conditions of mine fans, and these can be obtained by two-speed motors or by changing pulleys. Mine fans are generally belted on account of the low speed required so the latter method can be used easily. The practice of adding a three-phase commutating motor can only be justified by experience. Chairman Wood did not think the scheme was proposed as a panacea, but there are places where such an installation is justified. Messrs. G. Bright, Meyer-Delius, Oschman and Fast also joined in the discussion.

Owing to the pressure on our columns this week, the remaining papers of the afternoon session with those of the Saturday morning session and the discussions on each will appear in a subsequent issue.

Discussion of Wisconsin Public Service

Eighty utility men and manufacturers' representatives attended a public hearing held by the Railroads Commission of Wisconsin in Milwaukee on April 22. There was a general discussion of the proposed revision of the standards for gas and electric service in Wisconsin which have been in force for five years. Mr. David Harlowe, commissioner, presided. Prof. Charles F. Burgess conducted the technical discussions. The testing of meters, intervals between tests, meter records, the providing of modern illuminants, fees to be charged for tests and similar subjects were brought up. A committee of the Wisconsin Electrical Association, through Mr. F. A. Vaughn, commented on the proposed rules and ample opportunity was afforded for free discussion. An account of the discussions will appear in a later issue.

The New Missouri Commission Law

The recently enacted public service commission law adopted by Missouri, mentioned on page 819 of our issue of April 19, gives the commission jurisdiction over railroads, street railroads, common carriers, express and sleeping-car companies, and gas, electric-light, power, heating, water, telephone and telegraph companies operating or doing business within the State, and abolishes the Railroad and Warehouse Commission. Every gas, electrical and water corporation and every municipality is required to furnish safe, adequate and reasonable service and facilities at just and reasonable rates. Every unjust or unreasonable charge is forbidden, including undue preference or advantage to any person and discrimination in general. The quality of service will be investigated from time to time and standards of service will be established. Uniform accounts and annual reports to the commission are also among the requirements. Rate schedules must be displayed in public and changes in rates must be preceded by thirty days' notice to the commission. Sliding scales for the automatic adjustment of rates for service and dividends paid to stockholders will be permitted for fixed periods.

The provisions for inspecting and testing meters are already familiar owing to their general similarity to provisions in the laws of other states. Sales, leases, mergers, mortgages or transfers of property are subject to the commission's approval. No public-utility corporation may hereafter acquire stock in a similar utility, except that where a majority of stock is now lawfully held the remainder may be acquired upon consent of the commission. Security issues are also under the commission's jurisdiction; no franchise may be capitalized at more than its actual cost, and in mergers the amount of new stock issued shall not exceed the sum of the old stock and any cash actually paid in addition. Depreciation reserves, established under the direction of the commission, will be required and interest on the funds shall be added thereto. In rate making due regard shall be had for a reasonable average return upon capital actually expended and the necessity of making reservations out of income for surplus and contingencies. Provision is also included for valuation of property by the commission.

The provisions in regard to telephone and telegraph corporations are in general similar to those above. Physical connections between different systems when they can reasonably be made and are needed to serve the public will be required. No such corporation hereafter formed shall commence to build a plant without a certificate of public convenience and necessity. Stock, bond or scrip dividends are forbidden unless specially authorized. Review of the commission's decisions or orders by the Circuit Court of the county where the hearing was held or where the commission has its principal office, with right of appeal to the Supreme Court of the State, is among the provisions common to such public-utility laws. Appeals to the courts take precedence over all other civil cases except election contests. The health and safety of employees, passengers, customers and the public as affected by any railroad or public utility system are under the jurisdiction of the commission.

Public-Utility Bills Before Illinois Legislature

Among the bills introduced in the present session of the Illinois Legislature to create public-utility commissions, the two which seem most important are the one recommended by a majority of Senator Dailey's joint legislative committee and the one favored by Governor Dunne, known as the administration bill.

The Dailey bill provides for one commission for the entire State. There are to be five members of the commission, each to receive a salary of $10,000. Two of these are to be from the city of Chicago, one from northern Illinois, one from central Illinois and the remaining member from southern Illinois. The bill provides for uniform accounting, the supervision of stock and bond issues, power to investigate the affairs of utility companies, power to make physical valuations, to fix rates and to make rules and regulations necessary to conduct a just and equitable system of regulation. The bill does not affect the existence of the present Railroad and Warehouse Commission, although the committee recommends that ultimately this commission shall be abolished. The committee also contends that the cost of maintaining the commission should be paid by the utility companies themselves, and it is provided in the bill that a tax of $100 for this purpose be made upon each utility company in the State, with an additional imposition of one-tenth of 1 per cent upon the gross earnings of such companies. It is said that the annual cost of maintaining the Wisconsin commission is about $100,000, that of the commission for the Second District of New York about $300,000, and that of the commission for the First District of New York about $1,300,000. In the judgment of the Dailey committee a single commission for Illinois would require an expenditure of about $400,000 a year.

The bill favored by Governor Dunne is modeled largely after the California law. It would create a state commission, but give to Chicago and all the other cities of the State having a population of more than 25,000 the option of regulating their own utilities or turning this power over to the state body. The Dunne bill abolishes the Railroad and Warehouse Commission. It also provides for five commissioners with salaries of $10,000 each. The situation in the Illinois Legislature is such that observers familiar with political conditions are of the opinion that no public utility commission bill will be passed at this session.

Massachusetts Commissions to Have Increased Powers

Governor Foss has signed a bill giving the Massachusetts Railroad Commission and the Gas and Electric Light Commission authority to examine the books, accounts, contracts, records and memoranda of the trustees of any voluntary association or express trust holding the capital stock of any public service corporation under their jurisdiction, and to require such trustees to furnish such reports and information as the board shall from time to time direct with respect to the relations and dealings between such trustees and any such corporation. Similar authority is granted each of the commissions to investigate and require reports from any voluntary association or holding company under the same ownership, control or management as a corporation subject to the supervision of either board. The act (Ch. 509) also contains a section stating that nothing in its terms is to be construed as requiring either board in making any recommendations, rulings or orders with respect to rates charged or the service furnished by any corporation subject to the supervision of either board to take into consideration in any respect whatsoever any certificates of participation or shares issued under a declaration of trust and representing the beneficial interest in the stock, bonds, notes or other securities of such a corporation or the investment in such certificates or shares.

Public Service Commission News

New York Commissions

The New York Railways Company has served upon the Public Service Commission, First District, a writ of certiorari, issued by the Supreme Court, to review the action of the commission in requiring the company to set aside 20 per cent of its gross earnings each month for maintenance and depreciation. This requirement was embodied in an order of the commission approving the mortgages issued by the New York Railways Company in the reorganization of the old Metropolitan Street Railway Company, which it succeeded. The company claims that the commission has no authority to make such an order and that in so doing it illegally substitutes the judgment of the commission for the judgment of the company's directors.

The Public Service Commission, Second District, has ordered the New York Telephone Company to make an addition to its line extending along or near the Buffalo-Batavia State Road from the end of its present line to connect with the eight subscribers located on or near this road, provided that one or more of the subscribers give a bond covering the taking by the eight subscribers of multi-party-line service connected with the company's Williamsville exchange for a period of three years at a rate not less than $18 per annum as a base rate plus $2 per quarter mile as line mileage. The order is made following the complaint by a resident within 2 miles of where the company's line is now constructed and 4 miles east of Williamsville on the Buffalo-Batavia State Road. The Pioneer Telephone Company's line now ends about 1½ miles to the east of complainant's residence. The company refused to make the connection, except upon the building of 2 miles of line at a cost of $670 and an annual rental of $66. The commission is of the opinion that the company should make the extension upon the filing of a bond which was offered by complainant, and the New York Telephone Company may, if it wishes, work out an arrangement for the extension of the line by the Pioneer Telephone Company, which operates in the locality in question.

Maryland Commission

A special report was presented to the Public Service Commission last week by a committee named by that body to go into the regulations concerning electric wiring in Baltimore. The question was brought up several months ago by a complaint that the Consolidated Gas, Electric Light & Power Company had required a larger wire than was specified by the Department of Public Safety and the Fire Underwriters. While the complaint was withdrawn the commission decided to take up the entire question. The committee named was composed of representatives of the inspector of buildings, the State Board of Electrical Examiners, the Electrical Contractors' Association, the Consolidated Gas, Electric Light & Power Company, and the Public Service Commission. The report, which is voluminous, comprises a set of supplementary rules which it is recommended that the electric-light company be required to follow. These do not interfere with the existing rules as set forth by the Department of Public Safety or the Fire Underwriters, but add to these requirements.

New Jersey Commission

The New Jersey Board of Public Utility Commissioners has dismissed the application of the Consumers' Gas Company, Millville, for approval of an ordinance granting it permission to operate in that city. The decision is based on findings that the supply of gas now furnished by the Millville Gas Company is fully adequate for present and future needs, that the price charged is practically as low as that in any other section of the State, and that the introduction of a competing company into the field would not be for the public interest. The board upholds its previous opinion, that competition on the part of public-utility companies does not necessarily tend to the public's good.

Current News Notes

Lecture on the Dayton Flood.—A lecture on how Dayton was restored, illustrated by moving pictures and lantern slides, was given on April 23 at the New York Edison Company's auditorium by Messrs. John W. Lieb, Jr., and S. G. Rhodes. Mr. Lieb and Mr. Rhodes, who were among the first engineers to arrive at the stricken city, devoted themselves chiefly to restoring the lighting service. With the assistance of men from the central stations in New York, Chicago, Cleveland and other cities, temporary service was restored in remarkably short time, as has previously been reported in these columns.

* * *

St. Louis Taking an Electrical Census.—With the object of showing the strength of the electrical interests in St. Louis the St. Louis League of Electrical Interests of that city (Jovian Chapter) is compiling a census of electrical industries, intended to show, among other things, the total number of employees, the number of heads of families and the total number dependent for support on electrical concerns. Blanks on which the desired statistics may be entered have been sent to the members of the league by Mr. Ell C. Bennett, secretary and treasurer. It is believed that instructive and interesting information will be obtained in this manner. The results will be furnished to the daily and technical press.

Correction in Name.—In the "Digest of Current Electrical Literature" of the *Electrical World* of March 29, page 686, credit was erroneously given to Mr. C. S. Wall for the article on separation of leakage reactance and direct magnetizing effect which appeared in the London *Electrician* of Feb. 28, 1913. The writer of the article was Mr. T. F. Wall.

* * *

Public Lighting Contracts in Ontario Hereafter to Be Passed on by Electorate.—Hon. Adam Beck has introduced a bill in the Ontario Legislature which will have a far-reaching effect on municipalities which desire to make contracts with private companies for the supply of electricity for light and motor service. Under the present law it is necessary for a vote of the people to be taken before the municipality can enter into a contract with the Hydro-Electric Power Commission of Ontario, but if the council of any municipality desire to enter into a contract with a private company it can do so without consulting the electorate, provided the power obtained is destributed by the municipality. The bill introduced by Mr. Beck puts private power companies on the same footing as the Hydro-Electric Commission with regard to the making of contracts for furnishing of electrical energy.

* * *

SOCIETY MEETINGS

Annual Meeting Chicago Section, Electric Vehicle Association.—At a meeting of the Chicago Section of the Electric Vehicle Association on April 22 plans were discussed for the annual session and banquet of the section, to be held May 6 at the Hotel Sherman, Chicago. Mr. John F. Gilchrist, Commonwealth Edison Company, will preside as toastmaster, and there will be addresses by Mr. Arthur Williams, of the New York Edison Company, president of the Electric Vehicle Association, and Mr. E. E. Witherby.

* * *

Convention of the California Electrical Contractors.—The fourth annual convention of the California State Electrical Contractors' Association will be held at Santa Barbara from Aug. 13 to 16, with headquarters at the Hotel Potter. An exceptionally good program of practical papers is being arranged, as well as entertainment features that will greatly add to the pleasure of the occasion. The committee of arrangements includes Mr. J. C. Rendler, chairman, and Messrs. C. Loveday, J. S. Reynolds, W. S. Hanbridge and F. Neilson.

* * *

Illuminating Engineering Society Meeting.—On Thursday evening, May 8, at 8:15 o'clock, the Illuminating Engineering Society will hold a meeting at the Clymer Street Theater, 162 Clymer Street, Brooklyn, N. Y., at which Mr. Bassett Jones, with the co-operation of the Hewell-Basing Studios, will deliver a lecture on stage lighting. The lecture will be demonstrated with scenery, modern stage-lighting devices and living models. It is proposed to meet for dinner at the Café Boulevard at 6 p. m., from which place special buses will be provided to convey members and guests to the theater and return. The secretary of the section is Mr. Clarence L. Law, 124 West Forty-second Street, New York.

* * *

Electric-Vehicle Educational Work of Trade Union.—In a paper entitled "The Power-Wagon Driver," prepared by Mr. Daniel J. Tobin, general president of the International Brotherhood of Teamsters and Chauffeurs of America, and presented by Mr. William H. Ashton, general organizer of the same brotherhood, before the Electric Vehicle Association of America in New York on April 22, it was pointed out that the trade union of which these truckmen and drivers are members is doing much to educate the teamster of to-day to become the power-vehicle operator of to-morrow. The statement that the teamsters' union is opposing the introduction of electric and gasoline vehicles in place of those drawn by horses was refuted. In voicing the sentiments of the teamsters of America in his paper Mr. Tobin said that the teamsters and carriage drivers of to-day believe in the necessity of the motor vehicle.

* * *

Chicago Electric Club Listens to Dr. Millikan.—Dr. R. A. Millikan, professor of physics in the University of Chicago, was the speaker at the luncheon of the Electric Club of Chicago on April 17. He gave a scientific discourse on "Theories of Electromagnetic Radiation." Among other things he spoke of the work of the research laboratories of the General Electric Company and predicted that electric-lighting systems would be entirely changed in the next ten years, because of discoveries which will be made through research in relation to the conductivity of gases. The club adopted resolutions of condolence on the death of Mr. Francis B. Badt. A report was presented by the committee appointed to co-operate with the general entertainment committees of the National Electric Light Association in providing entertainment for visiting electrical men at the time of the N.E.L.A. convention during the first week in June. On recommendation of the committee the Electric Club decided to give a vaudeville entertainment during the convention and authorized the expenditure of $500 for that purpose.

* * *

Jovians' Activities in District of Columbia.—The monthly meeting of the District of Columbia Section of the Jovian Order was held on April 21 in the office building of the Potomac Electric Power Company. Statesman E. S. Marlow, manager of the commercial department of this company, presided. Mr. Arthur Dunlop, of the National Electrical Supply Company, spoke of the necessity of co-operation with the statesman in his administration. Mr. T. L. Townsend, vice-president of the National Electrical Supply Company, past-statesman, talked on the value of regular attendance and encouraged the members to take an active part in the proceedings. Elections to fill the offices of secretary and treasurer of the District of Columbia Section were held. Mr. C. B. Mirick was elected secretary and Mr. H. R. Carroll treasurer. During the early part of the evening a talk on the history of electric service in Washington and the various uses of electricity in connection with the home was given by Mr. G. P. Mangan, of the Potomac Electric Power Company. This talk was illustrated by motion pictures and lantern slides under the direction of Mr. H. A. Brooks, also of the Potomac Electric Power Company.

* * *

Officers of New York Companies Section, N. E. L. A.—At the monthly meeting of the New York Companies Section, N. E. L. A., held April 21, the following officials were elected for the ensuing year: Chairman, Mr. H. M. Edwards, of the New York Edison Company; vice-chairman, Mr. H. L. Snyder, of the New York & Queens Electric Light & Power Company; treasurer, Mr. W. L. Bruce, of the Westchester Lighting Company; executive secretary, Mr. F. C. Henderschott, of the New York Edison Company; recording secretary, Mr. J. A. Burke, of the United Electric Light & Power Company; executive committee, Messrs. H. M. Edwards, chairman; F. W. Smith, United Electric Light & Power Company; Stewart Wilder, Northern Westchester Lighting Company; I. M. Beatty, Peekskill Lighting & Railroad Company; Jesse Richards, New York & Queens Electric Light & Power Company; J. P. Radcliff, Jr., Yonkers Electric Light & Power Company; J. M. Butler, Bronx Gas & Electric Company; W. J. Clarke, Westchester Lighting Company; W. I. Donshea, the New York Edison Company; J. E. Phillips, Richmond Lighting & Railroad Company; Carleton Macy, the Queensboro Gas & Electric Company.

Central-Station Practice at Cambridge, Mass.—II

Commercial methods and service data of the company—Street-lighting and electric-vehicle service—Methods used in testing meters—Facts and factors

In a previous article an account was given of the recent developments in the generating station of the Cambridge (Mass.) Electric Light Company, with details of the application of low-pressure turbo-generators to the existing steam-engine plant, the tests made upon the first low-pressure unit installed, and various operating data pertaining to the generating equipment. Reference was made to the highly diversified character of the load carried by the system, and its interest from the commercial side was implied. The present and concluding article deals chiefly with the commercial phases of the company's work, including certain features of interest in connection with the distribution system and statistical data of interest from the analytical standpoint.

Apart from the diversified character of the service rendered, one of the most striking features of the company's work is the development attained along commercial lines with an unusually small organization. The population of Cambridge increased from 91,886 in 1900 to 104,839 in 1910, and with this gain came also a large increase in the manufacturing interests of the city. But the rapid growth in the earnings of the company must be attributed mainly to progressive management, to the maintenance of good service at rates in many respects lower than those in force in many larger cities, and to the solicitation of new business along the most favorable lines, although by a small force.

The company's gross earnings increased from $297,239 for the fiscal year ended June 30, 1908, to $430,495 in the corresponding fiscal year of 1912, while the gross receipts for the calendar year 1912 were $453,063. The gross sales for the month of January, 1913, were $46,240, compared with $45,453 in the previous year, important reductions in rates having been put in effect during the period which elapsed between these two dates.

Business Headquarters

The main offices of the company, shown in an accompanying illustration, are located on the Blackstone Street property adjacent to the power house and contain the usual quarters for the executives and heads of departments, clerical force and subordinate employees in the commercial and engineering service. A large storeroom, a machine shop and a meter-testing room are also located in the building, and in the yard outside a garage for electric and gasoline cars is conveniently located.

The Cambridge company maintains no appliance exhibit, but carries a small stock of induction motors ranging in size from 0.5 hp to 20 hp, all wound for three-phase, 550-volt service. Two motors of each of the 1-hp, 2-hp and 3-hp sizes are carried, which are always available for emergency service or for immediate installation. The company acts as agent for a prominent motor manufacturer and sells the motors from its stock subject to momentary demands.

At the entrance of the office building is installed a company sign in the shape of the emblem which is used on its stationery of various kinds, company publications, vehicles owned by the organization, badges carried by employees, and at pay stations located throughout the city. A typical sign of this type is shown in an accompanying illustration. It is illuminated by forty-four 8-cp, 10-watt, 25-volt tungsten lamps installed twenty-two on a side and supplied

FIG. 1—ORNAMENTAL LIGHTING OF MASSACHUSETTS AVENUE, CAMBRIDGE, MASS.

with energy from a separate transformer connected with the lighting mains.

At the cashier's window in the main office seats are provided for the public. A lamp exhibit has been installed in an unused window space at the rear. Two rows of seven lamps each are wired to the office-supply circuit, the sizes ranging from 10 watts to 250 watts. The bases are at-

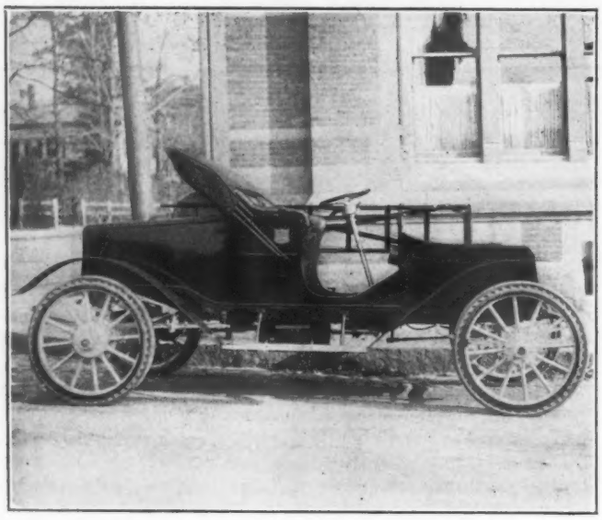


FIG. 2—ELECTRIC RUNABOUT OF CAMBRIDGE ELECTRIC LIGHT PLANT

tached to shelves 1 in. thick extending across the window space and 12 in. apart.

Rates for Service

The company's charges for service as defined include general lighting, yearly lighting, power, contract power and miscellaneous energy rates. A price of 11 cents per kw-hr. is charged for all electricity used under the lighting rate up to and including 667 kw-hr. per month, with a discount of 1 cent per kw-hr. for payment within fifteen days of the bill's rendering. Between 667 kw-hr. and 1934 kw-hr. per month a 7-cent rate is charged without discount, and the price decreases in several steps to a minimum of 5.5 cents net per kw-hr. for all consumption equal to or over 4949 kw-hr. No minimum charge is made under this rate.

In case a customer whose lighting consumption equals 1934 kw-hr. per month elects to supply his own lamp renewals, the company deducts ½ cent per kw-hr. for all electricity used under this rate. The company also sells electricity for any purpose under yearly lighting rates to customers who have signed contracts for yearly electric service in addition to the regular application embodying the company's terms and conditions. A service charge is made of $48 per year per kilowatt contracted for and is payable in regular monthly instalments. In no case, however, is such a contract closed for less than ¼ kw. The service charge itself includes the supply of no energy, an operating charge of 6 cents per kw-hr. consumed being made for all energy furnished under the yearly lighting rate.

Electricity for power use is defined by the company as that used in general motor service, cooking, heating, electroplating and the charging of storage batteries, but it does not include the operation of dynamos for electric-lighting service.

The "power" rates are 5.6 cents per kw-hr. for the first 660 kw-hr. used per month; 4 cents each for the next 2130 kw-hr.; 3 cents each for the next 930 kw-hr., and for the next 1280 kw-hr. and above, 2.5 cents per unit, with a 10 per cent discount for fifteen-day payment. A minimum charge of $1 per horse-power of demand is made. In dealing with elevator service the company assumes the demand as equal to the rated horse-power of the motor. When a customer signs a contract for three years or longer to pay for 5000 kw-hr. per month minimum consumption, electricity for motor service only is sold under a schedule with an initial charge of $163.58 for the first 5000 kw-hr., a charge of 1.85 cents per unit for the next 10,000 kw-hr., decreasing to a charge of 1.75 cents for the maximum consumption. When the meter readings of a contract customer show a use of his installation of 340 or more hours per month, his service is charged under a schedule which begins with $163.58 for the first 5000 kw-hr. and drops to a price of 0.75 cent for a consumption above 780,000 kw-hr. per month.

Off-Peak Rates

Under its miscellaneous energy rates the company now sells electricity for battery charging, cooking, heating, refrigeration, water supply and pumping, provided the customer agrees to use no service between 3 p. m. and 6.30 p. m. from Oct. 20 to March 10. The off-peak schedule is 5 cents net per kw-hr. (when paid promptly) for the first 70 kw-hr. used per month, 3 cents net for the next 1930 kw-hr., and 2 cents per unit for over 2000 kw-hr. A minimum charge of $1 per kilowatt of demand is made.

To insure the company against the use of energy during the hours exempt, the customer is required to provide a time clock at his own expense. If the customer is using energy for lighting, he is, however, allowed to charge batteries during the hours exempt, at a 10-cent rate. A customer who desires to use electric service as an auxiliary to another source of power or light may do so by paying a minimum charge of $2 per kilowatt per month for as many kilowatts as it is possible for him to use on the service

FIG. 3—ELECTRIC SIGN AT PAY STATION

at any one time. No lamps or renewals are supplied for such service.

The company reserves the right to install on any of its services a circuit-breaker arranged to disconnect the supply, if the demand arranged for that point is exceeded. In the supply of temporary service the customer pays the cost of installing and removing all equipment in addition to the

gross rate for electricity used. If, however, the customer is already a purchaser of the company's service, and if sufficient advance notice is given, the company allows the usual discounts for such a temporary service, provided the use amounts to 275 kw-hr. or more per month.

Distribution Practice

The company runs, free of charge, its service wires to the first support on the consumer's premises provided it is not over 125 ft. from the mains. Any construction beyond this, if on private property, is paid for and owned by the customer or property owner. If the required extension is on the highway, it is built and owned by the company and is installed only after special agreement with the customer. Where the service mains are overhead and an underground service is desired, the company will install the latter, charging for all labor and material from the lowest cross-arm on the pole to the building, deducting from this cost the price of the cables on the street side of the property line, provided the length of free cable does not exceed 100 ft. per service. If this underground work is installed by any one other than the company, it must be done under the supervision of the latter.

The company installs conduits and cables 2 ft. inside the customer's building, charging only for such portion as is inside the property line, provided the service entrance is located at the nearest point to the company's service. It is the practice of the company to supply but one service entrance for any building or group on the same property. The company furnishes and installs free of charge one master meter for lighting and one for motor service.

All other meters measuring the same or a part of the same service are considered to be special meters and are

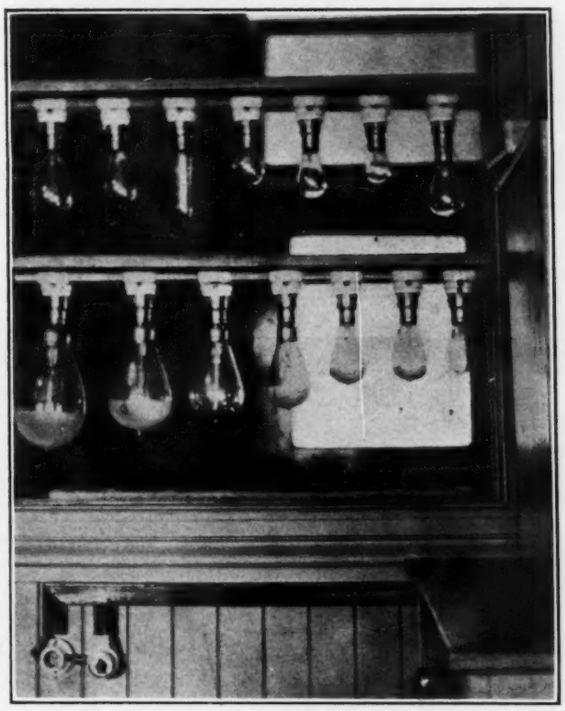


FIG. 4—LAMP DISPLAY IN UNUSED INTERIOR WINDOW, CAMBRIDGE

thus subject to a rental charge of 25 cents per meter per month up to 5 kw capacity and 50 cents above this. The arrangement is convenient in the supply of electricity to industrial plants and college dormitories. The former, for example, often desire to meter the energy consumption of different departments separately in order to obtain accurate cost analyses. Standard fuses for new work or renewals are furnished by the company slightly above cost. When called to restore a service out on account of blown fuses, employees of the company replace free of cost main fuses only.

Lamp Renewals

On new installations the customer pays 15 cents apiece for incandescent lamps up to and including 50-watt carbon

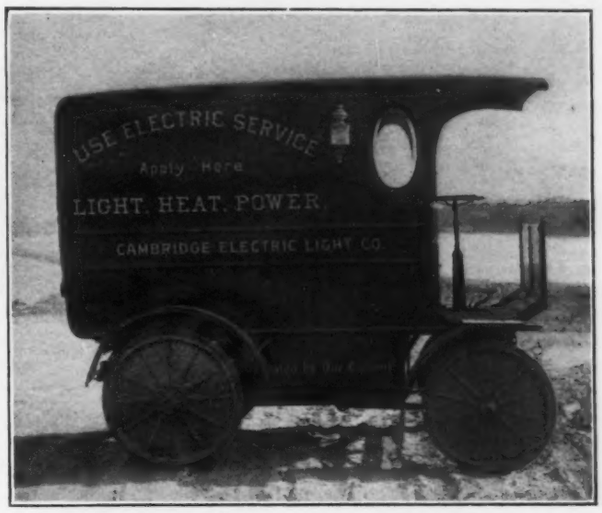


FIG. 5—CENTRAL-STATION COMPANY'S ELECTRIC TRUCK

or metallized units, but pays the renewal price if the original installation is of the tungsten type. Carbon lamps of the 2-cp and 4-cp sizes are renewed free, as are 30-watt, 50-watt and 80-watt metallized-filament lamps, while the prices for tungsten lamp renewals range from 30 cents each for the 15-watt, 25-watt and 40-watt units to $2.15 for a 500-watt lamp. The usual free renewal of unbroken carbon lamps is made.

The company also "trims" or maintains illuminated signs free of charge where the lamps are readily accessible. Electric signs are being standardized on the basis of 12-volt tungsten service with separate transformers. The size of lamp generally used is 4 cp. No flat-rate lighting exists on the system. On the company's station an electric sign is in service equipped with 290 2-cp carbon lamps wired for 110 volts and facing the Charles River Parkway.

All installations in excess of 1200 watts are designed for three-wire distribution and carefully balanced. When the installation exceeds 1200 watts in an individual unit, the company requires it to be wired for 220 volts, so that it can be connected to the outside of the system, and this regulation applies when additions raise the total connected load above 1200 watts, the only exception being in cases where temporary service is needed.

For the past seven years the Cambridge company has been grounding its secondaries by No. 4 and No. 6 copper wire attached to water pipes. The ground is usually made by driving a galvanized-iron pipe 15 ft. long into the ground, with a coil of about 12 lb. of No. 4 bare copper wire at the bottom and a bag of charcoal on top of the coil.

Transformers are being banked to give neighborhoods better service, from three to four transformers being frequently used per bank with an average of two grounds per bank on the secondaries. The company uses No. 00 wire for 2300-volt lighting feeders and No. 0 for 2300-volt power feeders, the distribution services being usually of No. 0000 copper in both the overhead and underground districts. No. 6 cable is used in underground street-lighting work and No. 4 wire in overhead street-lighting distribution. The smaller size is not favored for outside work. The largest power transformer is rated at 100 kw and the largest for lighting service at 50 kw.

The company does not allow single-phase motors above ½ hp in rating installed on lighting services. When motors not above this size are wired for metering separately from the lighting service, the company grants them a "power" rate but in all other respects considers them a part of the lighting service. Mercury arc rectifiers are treated as single-phase motors, except that a larger capacity than

FIG. 6—ATTENDANTLESS SWITCHING AND METERING STATION FOR TOWN OF BELMONT

½ hp is permitted. The company requires that all motors larger than ½ hp in rating shall be wound for 550-volt, three-phase service, and when they are over 5 hp in rating it requires the provision of a starting box in order to prevent disturbances of the company's other devices. When a motor larger than 15 hp is to be installed the company advises consultation in order to secure the most acceptable type of installation.

These distribution and service requirements have been worked out with unusual care, and prospective consumers are provided with a booklet of about thirty pages which gives in detail the steps necessary to be taken before service can be had, the limitations upon the various installations and the burdens which can and which cannot be assumed by the company in its relations with its customers.

Rentals and Free Trials

In emergencies the company is prepared to rent motors to meet conditions resulting from breakdowns of apparatus. It makes a regular practice of installing motors for a

TABLE I—CONNECTED LOAD DATA

	Kw
Municipal arc lamps	301
Commercial arc lamps	72
Municipal incandescents	55
73,785 carbon lamps, 50-watt equivalents	3,689
14,966 tungsten lamps, 40-watt equivalents	599
129 Nernst lamps	11
Total connected lighting load, about	4,727
Electric motors, 1135 in service	6,045
Total connected load of system	10,772

free trial of one week, including free energy for that period, and has secured much business in this way. It does all the wiring in such cases, and if the consumer decides on electric service the cost of wiring is later paid by him in cash or instalments. The free trial is extended for a month beyond the first week if the customer pays for energy consumed after the initial period. Demand indicators are not used, but the company tests individual installations as required. Electric flatirons are installed on a two weeks' free trial, the company selling 3-lb. and 4-lb. irons for $3.60 each and 5-lb. irons for $3.90. About 70 per cent of the irons thus put out are retained. A card index of all appliances placed by the company is maintained.

Electric-Vehicle Practice

The company has taken an active interest in the electric-vehicle campaign of the Greater Boston central-station interests and has operated six machines for some time. Two 5-ton General Motors trucks were purchased very recently, making a total of eight. In service at present there are four commercial cars, of 750-lb. to 1000-lb. capacity, and two small runabouts. The equipment includes one Bailey car, capable of making 28 miles per hour, which is equipped with a ladder for the use of troublemen and with tool boxes fore and aft. This car is used in the daytime by the installation department and at night by patrolmen on the street-lighting system. The machine runs between 8 a. m. and 10 p. m. and makes about 40 miles per day. It is provided with broad steps and easily carries four men.

Another equipment is the 1000-lb. Walker car shown in the illustration. This car is provided with an Edison battery and solid tires and makes about 25 miles per day. It is used by the meter department about eight hours per day and is employed as a traveling office by the company, carrying contract blanks and lamps for renewals. Orders for service are taken by the employees who man the vehicle, and a considerable amount of new business has been secured at the sidewalk curb with the use of this machine. It is employed mainly in the downtown district of the city. Other electric vehicles include a 750-lb. Waverley chassis which the company has supplied with a body used by the installation and lamp-delivery service. This machine carries an 8-ft. ladder concealed in a 6-ft. x 16-ft. side box and used mainly in store work. It operates eighteen hours daily and averages about 1000 miles per month. A Rauch & Lang runabout, used in about the same service as the last-named machine, carries a step-ladder on its side and is a valuable asset in the work of the company. The other two machines are used mainly by employees of the sales department.

The two large trucks just purchased are to be used in hauling coal from the company wharf on Broad Canal to the power plant, eliminating the present extensive storage of coal on the border of the Parkway. There are few hills in the territory and the distances are comparatively short on account of the density of population in Cambridge.

All company electric automobiles are equipped with Sangamo ampere-hour meters, and the greater part of the charging is done at night in the company garage adjoining the power house. Eight machines can be charged simul-

FIG 7—2-HP MOTOR DRIVING SEWING MACHINES

taneously. Each charging circuit is equipped with a watt-hour meter and a separate rheostat. There is also a special charging circuit for large trucks which cannot enter the building. This line is run to the doorway of the garage, so that a maximum of 120 amp at 110 volts can be delivered as required at this point.

The individual charging circuits vary in capacity from

30 amp to 60 amp, and energy is supplied from the station exciters. The company charges a minimum of 50 cents for a boosting charge and bills energy at the rate of 5.5 cents per kw-hr. Specific-gravity readings are taken on all acid cells weekly and on Edison cells monthly. One man looks after the electric-vehicle equipment and keeps the records by the aid of the company's charging blanks. On the reverse side of the form are cell diagrams facilitating recording the specific gravity and other readings. Light repairs are made in the company machine shop, which contains a forge, two lathes and a drill press driven by a 5-hp motor, besides a 2-hp motor-driven double carborundum grinder. The latter with its supporting frame occupies a space only 4 ft. high, 27 in. wide and 19 in. long.

A motor-driven tire pump is used in the company garage, the device being small enough to be set in an ordinary window sill, as shown in the accompanying view. About thirty-six rectifiers are now in use in Cambridge at the regular "power" rates, and two public garages have lately been established which pay special attention to electric-vehicle requirements. The larger of these charges $20 per month for storage, washing, polishing and oiling an electric runabout, a price of 5 cents per kw-hr. being added for charging the batteries of either transients or permanent customers. This establishment, located near Harvard Square, is provided with a 12-kw motor-generator charging set and a three-position switchboard, with equipment.

Meter-Testing Facilities

All meters are tested by the company before going into service. Excellent facilities have been provided for this work at the main offices. The meter-testing board is illustrated herewith and contains five 32-in. panels. Direct-current meters can be tested up to 50-amp capacity at 500 volts and any commercial alternating-current meter can be tested up to 200-amp rating. The board is supplied with 500-volt direct-current, three-phase, 550-volt alternating-current and three-wire, single-phase, 110-220 volt alternating-current connections. Meters under test are mounted on backboards by ½-in. screw studs centered in 3-in. plates.

All main switches are provided with spade handles. Single-pole switches are fitted with knobs set at right angles to the blade, to enable them to be grasped more easily from the testing seats in front of the board. One panel is equipped with load switches controlling resistances giving a range of 0.1 amp to 150 amp, with 110-volt, single-phase supply. A second panel has a test range of 0.25 amp to

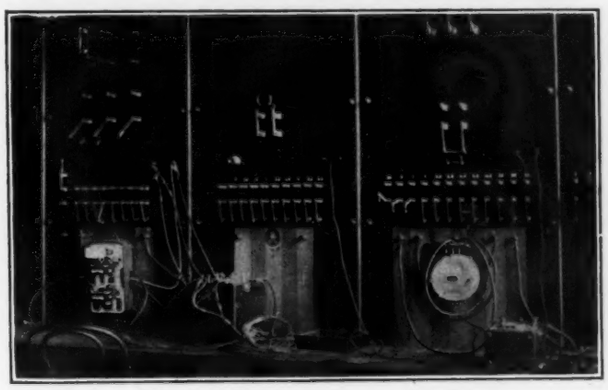


FIG. 8—SECTION OF METER-TESTING BOARD

100 amp on the 220-volt, single-phase supply. A third panel has a range of 0.25 amp to 35 amp on 110-volt, single-phase service, while a fourth panel has a range of 1 amp to 50 amp, with a special transformer switch supplying a maximum of 120 amp from the 550-volt alternating-current source.

Connections are also provided for testing the wattage requirements of heating appliances. Readings are recorded on a bench 20 in. wide, 1 in. thick and 30 in. above the floor, at the front of the test board. Lighting of the board is furnished by five 40-watt tungsten lamps installed 4½ ft. above the shelf and controlled by snap switches located under the latter for the convenience of the operator. Permanent non-inductive resistors for meter testing are installed

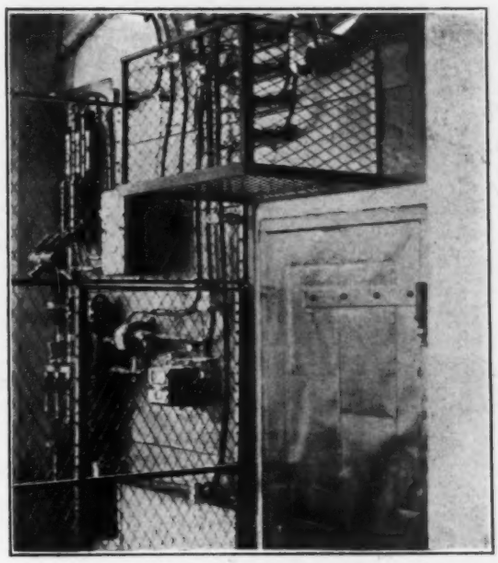


FIG. 9—TYPICAL FACTORY-SERVICE ENTRANCE

in a frame on the basement ceiling, the resistance elements being of lamps and non-inductively wound wire coils. Copper buses connecting the resistance elements form the top of the frame, the bottom of which is of asbestos board.

TABLE II—ANALYSIS OF CAMBRIDGE POWER EARNINGS

Number of motors on system June 30, 1911	947
Rating of motors on system June 30, 1911, kw	5,899
Average rating of motors, fiscal year 1912, kw	5,972
Average number of motors, fiscal year 1912	1,041
Average rating per motor, fiscal year 1912, kw	5.75
Kw-hr. sold for motors, fiscal year 1912	6,132,177
Average motor load in kw at installations, 365 days, twenty-four-hour basis	700
Average motor load in kw at installations, 365 days, ten-hour basis	1,680
Percentage of connected motor load in use, twenty-four-hour basis	11.7
Percentage of connected motor load in use, ten-hour basis	28.2
Revenue from sales of energy to motor users	$151,222
Average revenue per kw-hr. of sales for motors, cents	2.46
Average number power customers, fiscal year 1912	287
Revenue per power customer, fiscal year 1912	$525.00
Revenue per connected motor, kw	$25.00
Revenue per connected motor, hp	$33.50

Distribution at Harvard College Yard

The meter department uses Westinghouse single-phase and polyphase rotating standards, with portable Westinghouse and General Electric artificial loads for tests on lighting meters on the consumer's premises. Small meters are tested at least once a year, while those in large installations are checked about three times a year.

An interesting special meter installation was lately made for the electrical service of the Harvard College yard. Formerly some eighty-five separate meters for lighting and motor service were in use in the various buildings of the college-yard group. In the present arrangement the entire yard is served through a three-phase primary meter installation in the basement of the Harvard Union, a master meter being located in each dormitory and building around the yard. The college owns the conduits in the yard, while

the wires, cables and pole lines in the territory belong to the company.

The company pulls in the cables, and after the term is over at the beginning of the summer season all secondaries are open-circuited and the primary meter is read for several hours to determine the line and core losses. A special deduction is then made from the bills. The company reads

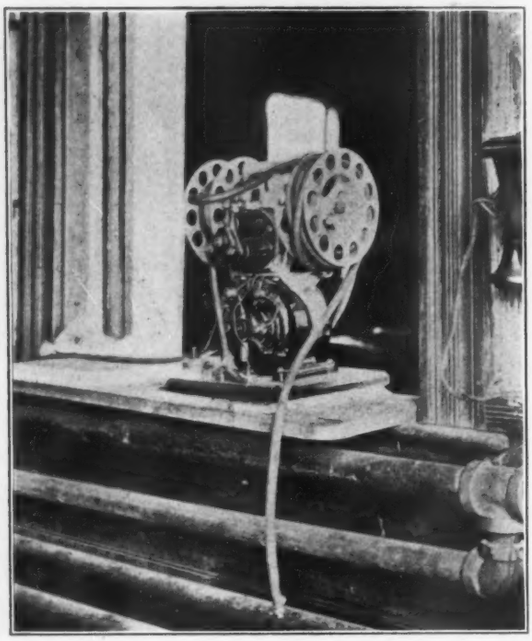


FIG. 10—MOTOR-DRIVEN TIRE PUMP IN COMPANY'S GARAGE

every student's meter and sends the owner of the dormitory, whether on the yard or elsewhere, a memorandum of the consumption. In most cases the owner deals with the student directly and his bill for electric lighting usually in-

TABLE III—CENTRAL-STATION FACTS AND FACTORS, CAMBRIDGE, 1912

Population served (excluding Belmont municipal distribution)	104,839
Number of consumers	2,732
Gross income (including about $5,000 miscellaneous)	$435,901
Kw-hours delivered at station buses	11,929,427
Kw-hours sold, total	10,083,962
Kw-hours sold for motor service	6,132,177
Kw-hours sold for street lighting	1,332,024
Kw-hours sold for all lighting	3,951,785
Earnings from street-lighting service	$72,032
Earnings from commercial lighting	$195,957
Total operating expenses and taxes	$236,566
Total liabilities, capital and loans	$850,000
Cost of plant (entire system) above capital and loans	$356,029
Excess of system cost over assessed valuation	$6,029
Total cost of system	$1,206,029
Total cost of steam plant	$341,504
Total cost of electric generating plant	$127,335
Plant rating, June 30, 1912, in kw	5,325
Cost of manufacture, net, at station only	$101,204
Total number of employees	81

cludes a charge for corridor and lavatory illumination. In the Harvard Square district the company has a connected load of about 250 hp in motors and 526 kw in lighting installations, the latter all being metered through the Harvard Union board, thus effecting a saving in bookkeeping.

Attendantless Metering and Switching Substation

In connection with the sale of energy to the town of Belmont an attendantless metering and switching station has been built at the town line. The installation is housed in a small frame building lined with corrugated iron. From it two 2300-volt, single-phase lighting feeders and two street-lighting circuits are run through the residential suburb of Belmont. The potential is regulated on the lighting feeders by a General Electric feeder regulator of 17.5-kw rating placed within the switch house. Both the services are metered within the house, but the special interest of the installation is the arrangement provided for automatic switching of the street-lighting circuits through the operation of a remote control in the hands of the local lighting superintendent 2.5 miles distant. Two oil switches with mechanical trips operated by a solenoid plunger are installed in series with each street-lighting circuit, the solenoid coils being in series with one side of the Belmont line.

The lamps are lighted by closing a push-button switch at the Belmont police headquarters or at the lighting superintendent's home. When the push-button is operated and held in for about five seconds a 0.1-hp, 220-volt single-phase motor in the switch house revolves a set of short-circuiting cams a half revolution, closing the oil switches between the Cambridge supply and the local lighting installation. To cut off the lamps, the push-button is again pressed, rotating the short-circuiting cams another half turn and short-circuiting the Belmont lines. This de-energizes the solenoids and the falling plungers trip the oil switches. The switch nearest the Cambridge supply in each circuit is of the Holmes short-circuiting type, so that when it is tripped the Cambridge circuit connected to it is short-circuited. By this means the local lighting service on the streets of Belmont can be cut in or out without interrupting the service on the Cambridge streets served by the same street-lighting feeders. In case of a short-circuit or heavy ground on the Cambridge side the withdrawal of current from the solenoids trips the oil switches. To guard against a total interruption of any length an extra constant-current transformer is installed in the switch house with its primary connected through an oil switch with the company's three-phase, 2300-volt mains, the secondary being plugged into the

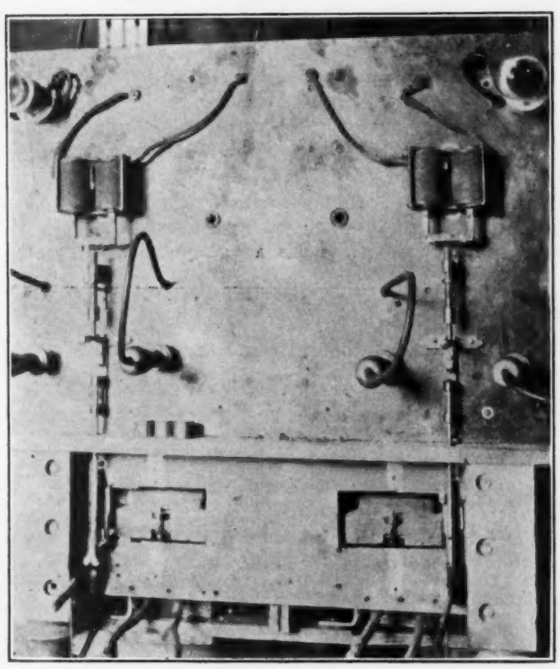


FIG. 11—AUTOMATIC SOLENOID TRIPS FOR STREET LIGHTING

street-lighting system on the Cambridge side of the meter to be available in case there should be trouble on the regular feeders.

Display Lighting on Massachusetts Avenue

The company has made an installation of display lighting within the last few months on Massachusetts Avenue, the

principal thoroughfare of Cambridge, between the City Hall and Lafayette Square, erecting thirty-eight two-lamp posts in a distance of about 2560 ft. The posts are of the Lundin type, and carry the lamps 18 ft. above the sidewalk by iron brackets supporting Wheeler radial reflectors immediately above the bulbs. Each lamp is a 200-cp, 6.8-amp series tungsten, the average distance between lamps on the same side of the street being 135 ft. The posts are staggered and the street is about 103 ft. in width at the points shown in the accompanying day and night views of the installation. These lamps are to burn 3910 hours per year at a price of $82.44 per post, one lamp of each pair being cut off at midnight. The circuits are arranged for future underground supply.

TABLE IV—UNIT DATA

Station rating in kw per station employee	222
Station rating in watts per capita	51
Connected load in watts per capita	103
Ratio in per cent of station rating to connected load	49.5
Average load for year in kw	1,360
Load-factor for fiscal year in percentage	29.2
Investment per kw station rating, total	$225
Total liabilities per kw station capacity	$160
Gross income per kw station rating	$82
Gross income per capita	$4.15
Gross income per $100 investment	$36
Gross income in cents per kw-hour sold	4.35
Gross income in cents per kw-hour generated	3.73
Investment in system per capita	$11.50
Ratio of operating expenses and taxes to gross income, per cent	54.27
Net earnings per $100 invested	$16.50
Gross yearly operating expense per $100 liabilities	$27.80
Total cost of system per hp of steam equipment	$158
Earnings from all lighting business per kw-hour sold, cents	7.2
Earnings from street lighting output per kw-hour, cents	5.4
Ratio in per cent of motor energy consumption to consumption of power installations on continuous full-load rating	11.7
Ratio of energy consumption of lighting installations in per cent of consumption at continuous full-load rating	9.5
Total connected load of system in kw per kw station rating	2.02
Number of customers per 100 population	2.6

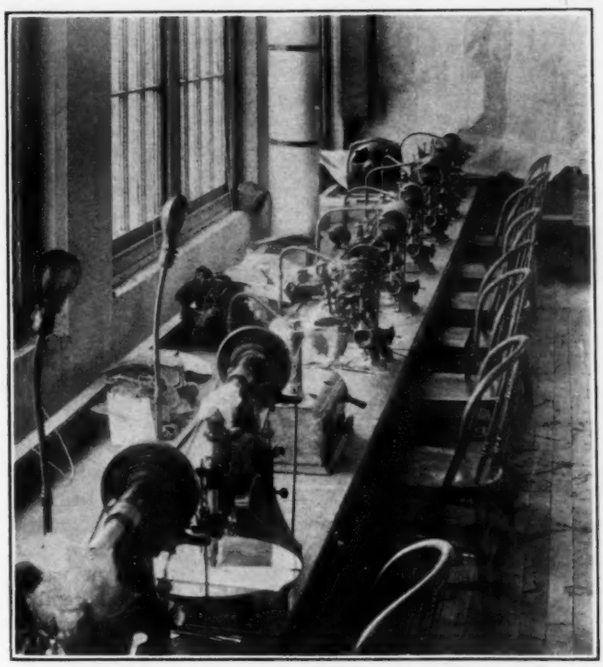


FIG. 12—MOTOR-DRIVEN SKIVING MACHINES AND PERFORATORS

There is also a movement on foot to eliminate the existing installation of 6.8-amp inclosed alternating-current arc lamps in all parts of the city, substituting 200-cp tungstens in the former globes. About 475 lamps have been replaced in this way and 175 have also been replaced with clusters of three 80-cp tungstens each. On June 30 last the company operated about 670 municipal arc lamps of the 6.8-amp, series, 450-watt size, but since that time the substitution of incandescents has been very rapid; in fact, within a month from the present time it is probable that not an arc lamp will be in use on the streets. The company is now replacing gasoline Welsbach lamps on the Charles River Parkway by about 200 40-cp series incandescent lamps giving all-night service, placed about 100 ft. apart and 13 ft. above the roadway. The cost of the electrical service is about 70 per cent of that of the gasoline lighting.

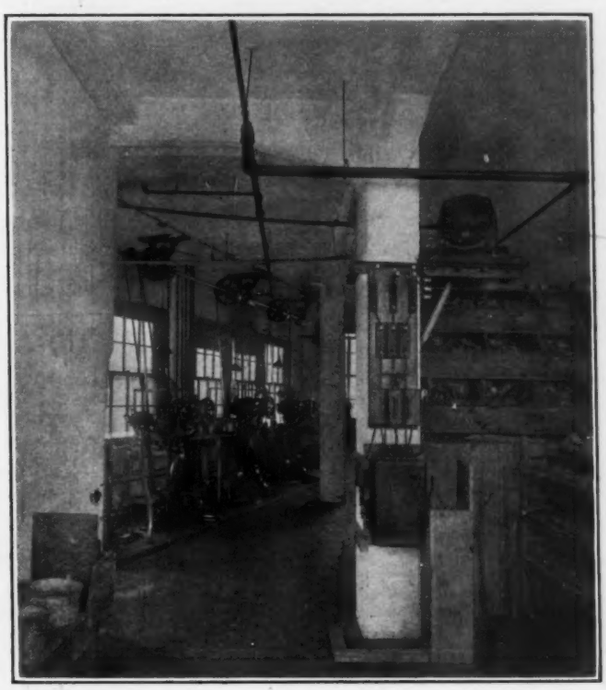


FIG. 13—STITCHING MACHINES DRIVEN BY 5-HP MOTOR

The connected load of the company on June 30, 1912, is given in Table I. Averaging this connected power load for June 30, 1912, with the connected motor load on June 30, 1911, gives the mean connected power load during the year as indicated in the accompanying analysis of industrial service earnings (Table II).

Typical Power Installations

The customers of the company using motors range from the largest packing house in the city to the smallest retail shops. Among the large users of electricity for motor service are the John P. Squires Packing Company, with a connected load of 2200 hp, a maximum demand of 1200 hp and a monthly energy consumption of about 200,000 kw-hr. This plant has about 125 motors in service, ranging in size from 0.5 hp to 50 hp. In connection with the load furnished by this house, the Cambridge company has suggested the installation of a 300-hp synchronous motor which would be run idle on the system during the months of November to January inclusive, twenty-four hours per day, to improve the system power factor. In the summer season this motor would be used to operate refrigerating machinery.

Another large customer is the Boston Woven Hose & Rubber Company, with about fifty motors of 1000 hp total rating and a monthly consumption of about 90,000 kw-hr. The motors range in rating from 0.5 hp to 50 hp. The Blake-Knowles Steam Pump Company also purchases power from the central-station system, about thirty motors

of 463 hp combined rating being in service and consuming about 51,000 kw-hr. monthly.

Other concerns taken almost at random from the company's large list are the Riverside Press of Houghton, Mifflin & Company, 100 hp, largely in individual motor drives; the University Press, with about 185 hp and 60 motors; Elliott Addressograph Machine Company, with 75-hp connected load; Commonwealth Glue Company, with 130 hp in motors and a monthly use of about 23,000 kw-hr.; the Barbour-Stockwell Company, maker of railway track fittings, 8000 kw-hr. monthly; Harvard College Observatory, the Davis Ice Cream Company, the Library Bureau, John H. Cross Company (shoes), Alberti Box Company, Simplex Electrical and Simplex Electric Heating companies, etc.

A Model Electrically Driven Shoe Factory

The John H. Cross installation, recently completed, is one of the most modern electrically driven shoe factories in the country and has a total equipment of about 180 hp in General Electric motors in service throughout four floors and a basement. This concern consumes about 15,000 kw-hr. per month and can manufacture 2400 pairs of shoes per day. It occupies a reinforced-concrete building in the new industrial section of the city, the motors ranging in rating from ½ hp to 15 hp. The group drive is largely used on account of the multiplication of duplicate machines in the 150 operations necessary in making a shoe. Electric heating equipment with rheostatic adjustment is a feature of this factory. A typical motor application is illustrated, with the method of attaching the motor to a bracket on a reinforced-concrete column. A view is also shown of the typical service entrance in the factory.

The Alberti Box Company utilizes about a dozen motors, with several individual drives and a total connected motor load of about 40 hp. The Davis Ice Cream Company, with 113 hp in motors, operates either of two 20-ton ammonia compressors, an ice crusher, brine pump, fans and ice carriers, with a consumption varying from about 9000 kw-hr. per month in winter to nearly 20,000 kw-hr. in each summer month. This plant, displacing a gas engine, was inaugurated on central-station service by a free trial motor of 20-hp rating, with a 3-hp motor on the ice crusher. The plant now has a capacity of freezing 3500 gal. in ten hours.

The auxiliary service of the Cambridge company includes an emergency electric-lighting connection of 90-kw rating with the Cambridge subway of the Boston Elevated Railway Company at a price of $2 per kilowatt per month. The service rendered Harvard University includes the operation of book lifts, lighting, the driving of ventilating fans in scattered buildings, laboratory machinery, a small printing plant and auxiliary connections with the principal dining establishments.

Publicity

The company is a firm believer in the benefits of newspaper advertising on the basis of a legitimate news interest in its work. Electrical energy was supplied by the company in the building of the Cambridge subway, as described in the *Electrical World* for July 28, 1910. The completion of this work in half the allotted time, and the testimonial of one of the best-known contractors in New England as to the superiority and greater economy of electricity over steam, were featured effectively in the press. The company has also taken advantage of the rigorously enforced Boston smoke law in advertising its service.

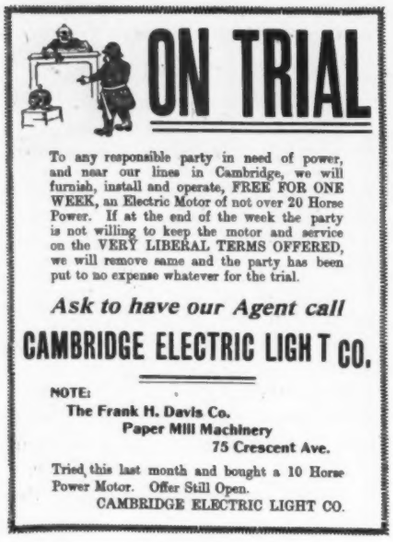

ON TRIAL
To any responsible party in need of power, and near our lines in Cambridge, we will furnish, install and operate, FREE FOR ONE WEEK, an Electric Motor of not over 20 Horse Power. If at the end of the week the party is not willing to keep the motor and service on the VERY LIBERAL TERMS OFFERED, we will remove same and the party has been put to no expense whatever for the trial.
Ask to have our Agent call
CAMBRIDGE ELECTRIC LIGHT CO.
NOTE:
The Frank H. Davis Co.
Paper Mill Machinery
75 Crescent Ave.
Tried this last month and bought a 10 Horse Power Motor. Offer Still Open.
CAMBRIDGE ELECTRIC LIGHT CO.

FIG. 14—FREE TRIAL PROPOSED TO PROSPECTIVE MOTOR CUSTOMERS

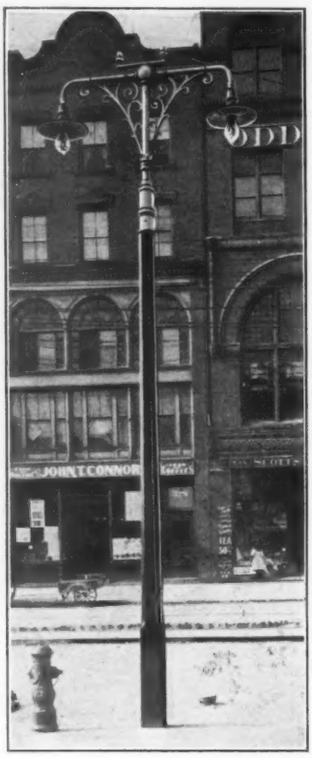


FIG. 15—ORNAMENTAL STANDARD, MASSACHUSETTS AVENUE, CAMBRIDGE

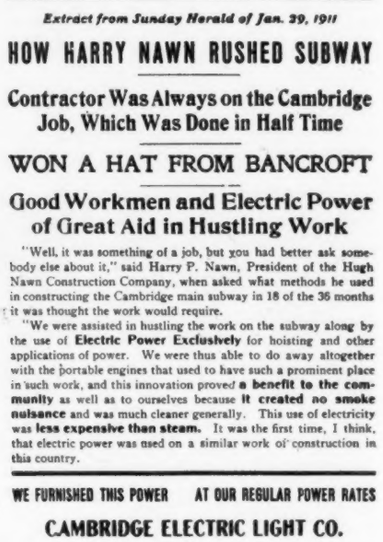

Extract from Sunday Herald of Jan. 29, 1911
HOW HARRY NAWN RUSHED SUBWAY
Contractor Was Always on the Cambridge Job, Which Was Done in Half Time
WON A HAT FROM BANCROFT
Good Workmen and Electric Power of Great Aid in Hustling Work
"Well, it was something of a job, but you had better ask somebody else about it," said Harry P. Nawn, President of the Hugh Nawn Construction Company, when asked what methods he used in constructing the Cambridge main subway in 18 of the 36 months it was thought the work would require.
"We were assisted in hustling the work on the subway along by the use of Electric Power Exclusively for hoisting and other applications of power. We were thus able to do away altogether with the portable engines that used to have such a prominent place in such work, and this innovation proved a benefit to the community as well as to ourselves because it created no smoke nuisance and was much cleaner generally. This use of electricity was less expensive than steam. It was the first time, I think, that electric power was used on a similar work of construction in this country.
WE FURNISHED THIS POWER AT OUR REGULAR POWER RATES
CAMBRIDGE ELECTRIC LIGHT CO.

FIG. 16—ADVERTISEMENT OF THE CAMBRIDGE ELECTRIC LIGHT COMPANY

The influence of the power load is illustrated by the fact that the peaks on the generating station during the months of 1912 occurred in the forenoon in March, April, June and August, and before 5 p. m. seven months of the year. The average daily output per month at the plant varied from 29,260 kw-hr. in July to 38,741 kw-hr. in December, the average for the year being 33,383 kw-hr. per day.

The peak load of the year was 4670 kw, occurring at 5 p. m. on Dec. 16, and the minimum peak load in any month, 2700 kw, occurred in April. The average load on the station in April was 1252 kw, giving a monthly load-factor of 46.5 per cent, the corresponding figures for December being 1614 kw and 34.5 per cent. For the calendar year 1912 the average station load was 1392 kw and the load-factor practically 30 per cent.

The officers of the company are: President, Mr. J. Q. Bennett, vice-president, Mr. J. Henry Russell; treasurer and general manager, Mr. Welles E. Holmes.

Investigation of Diffusing Glassware

By M. LUCKIESH

In the *Electrical World* for Nov. 16, 1912, the writer gave an account of a method for determining the light diffusion curves of glassware together with the results obtained on various samples procurable at that time at the physical laboratory of the National Electric Lamp Association. Other specimens have since been examined so that now the various types are well represented. For details of the method the reader is referred to the article just mentioned.

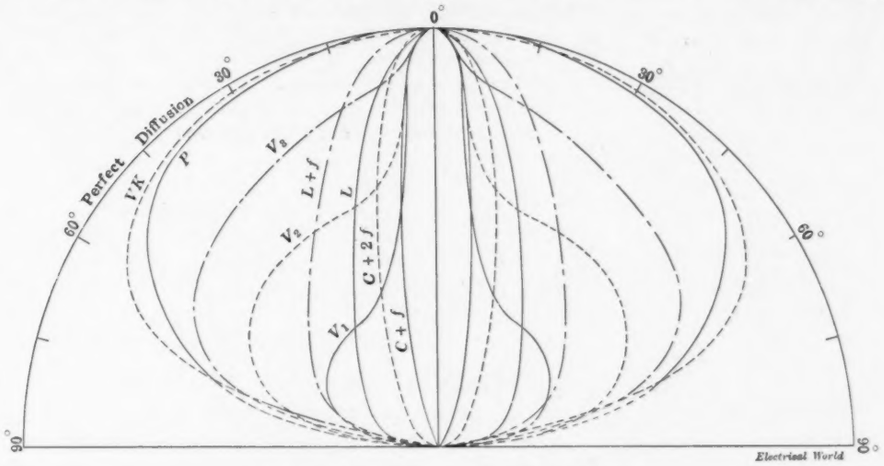


FIG. 1—BRIGHTNESS DISTRIBUTION CURVES

A circular orifice 1 in. in diameter was illuminated by means of parallel light incident normally to the surface. The specimens of diffusing glassware were placed in contact with this opening and the brightness was determined at various angles, the normal being taken as zero degrees. The brightness at various angles is plotted in Fig. 1 for the samples examined since the last paper was published. The brightness values multiplied by the cosine of the angle between the normal and the direction in which the glass was viewed give the candle-power distribution curves. These values are shown in Fig. 2. Nearly all the specimens are what would be termed satisfactory diffusing media, but notable differences in the character of the diffusion are very evident.

In Table I other data are to be found.

In order to make these data comparable with the data presented in the former paper, check measurements were made on flashed-opal glass. The original sample was not at hand so several determinations were made with other specimens. It was found that the opal coating is sufficiently uneven to cause wide variations in the brightness of different samples. The ratio of the brightness at 60 deg. from the normal to the glass to the brightness normal to the glass is taken empirically as the diffusion coefficient, as in the former paper. In general these specimens were more desirable than the former ones from the standpoint of the diffusion of light. It is interesting to note that flashed opal, *VK* and Pyro are practically perfectly diffusing.

The sample of *VK* examined in these experiments was about 1/16 in. thick, but it can be made thinner and yet retain its great diffusing property with a resulting higher coefficient of transmission.

The transmission is obtained by considering the shape of the diffusion curve together with the relative normal brightness given in column three of the table by Rousseau's method. In the first paper the transmission of a perfect diffuser is given as 100 per cent. Lest the fact that this is for a flat plate be lost sight of, attention will be called to the fact that this is in reality 100 per cent of one-half the light incident upon the glass (considering no specular reflection.) The transmission coefficients have been calculated for the second lot of samples, but because of the confusion arising from the fact that only flat plates are considered here the transmission of the ideal diffuser is taken as 50 per cent. However, the prime object of the investigation was to determine the diffusing properties of various kinds of commercial glassware. The transmission coefficients given here are of interest chiefly when diffusing glass in flat sheets is desired. The samples of Lucida examined here were cut from commercial reflectors. Those considered in the former paper were especially made in flat pieces. This, no doubt, accounts for the great difference in the two lots of samples. This difference is quite noticeable to the eye.

Three general types of diffuse transmission are found in this lot of specimens as in the former lot. It will be noted that there are samples which are practically perfectly diffusing. Other samples might be termed as showing a spread transmission. Etched or roughed surfaces tend to produce spread transmission. Some samples show a tendency to diffuse some of the light perfectly and to transmit directly (sometimes with a little scattering) the remainder which is not absorbed or otherwise lost. Most samples of this type transmit a faint image of the light source clearly defined.

In order to illustrate the great difference in the resultant transmission of hollow diffusing glass spheres and flat specimens of diffusing glass some data obtained by Mr. H. C. Meredith, of the engineering department, are presented in Table II.

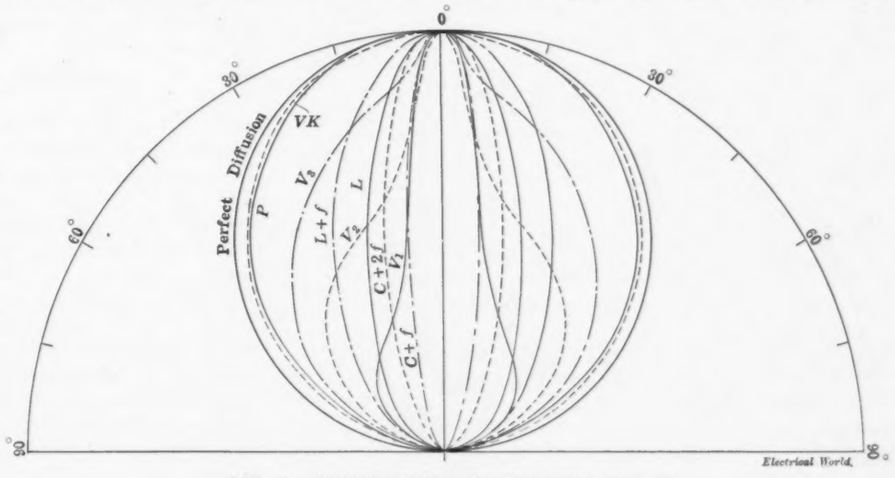


FIG. 2—CANDLE-POWER DISTRIBUTION CURVES

Nothing but the most general comparison can be made between the data given in the two tables because of the

unknown thicknesses of the glass in the spheres. Of course the "efficiency" of the spheres varies somewhat with their size under practical conditions, but the figures show very closely what degree of transmission can be expected.

TABLE I—DIFFUSION AND TRANSMISSION OF VARIOUS TYPES OF GLASSWARE

Curve. Kind of Glass	Relative Normal Brightness for Constant Illumination of Specimen	Diffusion Coefficient (Empirical), per Cent	Transmission (Flat Specimen), per Cent
Perfect diffusion. Ideal diffuser	1.00	100.0	50
O Flashed opal	....	88.0	30–50
VK No. 503 Welsbach shade, 1-16-in. thick	0.74	86.0	50
P Pyro, 1-16 in. thick	0.41	78.4	26
L Lucida, ¼ in. thick	2.80	19.9	67
L+F Lucida, one side frosted, ¼ in. thick	1.71	34.0	59
V_1 Veluria, ¼ in. thick	1.65	31.0	40
V_2 Veluria, 3-16 in. thick	0.79	52.0	33
V_3 Veluria, roughed inside, ¼ in. thick.	0.66	67.8	35
C+f Crystal, one side frosted	18.3	....	..
C+2f Crystal, two sides frosted	3.9	10.3	..

Among other experiments made is that of showing how a roughed surface changed the properties of a reflector. Instead of permitting the glass to change its angle with the line joining its center with the photometer, it was kept

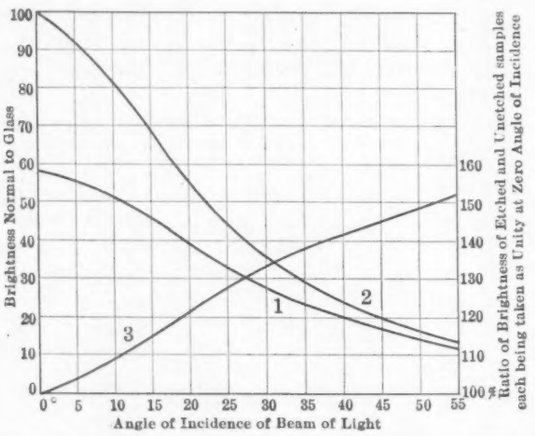

Brightness Normal to Glass
Ratio of Brightness of Etched and Unetched samples each being taken as Unity at Zero Angle of Incidence
Angle of Incidence of Beam of Light
1
2
3

FIG. 3—CURVES SHOWING RELATIVE NORMAL BRIGHTNESS

perpendicular to this line while the angle of the incident light was varied. Measurements of the normal brightness were made while the angle of incidence of the beam of light was varied from zero to 55 deg. This procedure was

TABLE III—TRANSMISSION OF VARIOUS TYPES OF GLASSWARE

Glassware	Transmission, per Cent
Alabaster	86.8
Alba plain smooth	85.8
Melilite (polycase)	77.6
Gleason Tiebout (polycase)	76.9
Opalescent	86.4
Opal	77.2
Verra Krasna (*VK*)	85.7
Veluria	88.0

carried out with an unetched sample of Lucida glass and with a sample roughed inside. The data are shown plotted in Fig. 3. Curve 1 represents the results with the roughed-inside sample, while curve 2 shows the relative results obtained for the unetched sample. These curves are reproduced for the purpose of emphasizing the fact that the character of the inside surface greatly affects the ability of the reflector to direct the light. In curve 3 is shown the ratio of the brightness of the sample with roughed inside to that of the unetched sample, their brightness at zero angle of incidence being taken as unity. As would be expected, the normal brightness of the roughed sample does not decrease as rapidly as that of the other sample with increasing angle of incidence of the beam of light. The curves show how an etched inner surface reduces the ability of the reflector to direct light, making it a better diffusing unit.

Representative glassware of all types readily obtainable has been examined. The writer acknowledges his indebtedness to those who kindly furnished the samples, and to Mr. Leonard Krill for assistance which was rendered by him in the experimental work.

Water-Power Plant with 300-Ft. Head at Longmont, Col.

The recently completed municipal electric-lighting plant for the city of Longmont, Col., utilizes a 300-ft. head for developing the power of its allowance of 10 cu. ft. per second from the north fork of the St. Vrain River. Two Leffel waterwheels are directly connected to a pair of 250-kw Fort Wayne alternators producing 2300-volt, three-phase energy. For transmission to Longmont, which is 12 miles distant from the water-power development, the emf is stepped up to 23,000 volts. Trussed-steel poles and pin-type insulators have been used for the transmission line. The substation at Longmont, transforming back to 2300 volts for local distribution, is unattended. Leading north from the station three-phase main primary circuits are carried, from which branch off single-phase laterals. Secondaries are to be grounded to avoid danger to life and property resulting from possible crosses with high-voltage wires.

Oil-Engine Set for Ship's Emergency Lighting

The *Titanic* disaster has called attention to the need for auxiliary sources of electrical supply for deck lighting and wireless-telegraph operation in case of the flooding of the main electrical generating equipment of a vessel that has become disabled.

In a large steamship now under construction at Dumbarton, England, trial is being made of a gasoline-engine set mounted on the bridge deck far from the possibility of immersion. The lightness of the unit has made feasible its positioning at this height without adding to the top hamper of the ship. By means of a throw-over switch energy for the deck lamps and wireless set can be taken either from the main generators or from the emergency set as may be more convenient.

The 28-hp Brooke engine is direct-connected to a 20-kw, 110-volt Siemens generator. The motor is of the standard vertical four-cylindered type, with Bosch ignition and alternative accumulator starting. The whole is mounted on a single bedplate, and the crank shaft, passing through the base of the radiator, which is situated between the engine and the dynamo, is direct-coupled to the dynamo shaft. The radiator is of the tubular type, with ample surface. Thermo-siphon cooling is used, and a powerful fan, driven by belt from the cam-shaft end of the engine through a shaft passing along the tops of the cylinders, induces a current of air sufficient to keep the radiator cool. Large movable inspection plates are provided to enable the crank pit to be examined, and the crank itself can easily be taken out should occasion require.

Central Station Management

Devoted to Discussion of Administrative Policies, Commercial Methods, and Current Practice Among Successful Utilities

Convincing the Directors

Some time ago the electric-light plant in a small Middle Western town was, in the words of its manager, "hobbling along, paying an ignominious dividend in return for an exorbitant amount of hard work and close management." The manager was not satisfied with the small dividend which the plant had been earning and at a directors' meeting suggested a combination ice-electric plant. A few figures and a little argument convinced the directors that the operating expenses would not be increased by the combination plant. The addition of a 10-ton refrigerating auxiliary was agreed upon. "And from that moment," continues this enterprising manager," the stock of this company has been something worth owning. We are now paying a good dividend, have installed two 100-hp boilers and added to the generating equipment and ice-plant machinery. There is outstanding at present only $11,000 in stock and $16,000 in bonds on our property, which is certainly worth more than $100,000, if the returns may be taken as any indication of the value of an investment. To say that we are enthusiastic over our combination plant would indeed be mild. I do not hesitate to add that the only way to make an electric-light plant in a small town pay a life-sized dividend is to make by-product ice."

Closing Ornamental Street-Lighting Contracts

In the smaller towns of its territory, particularly those varying from 300 to 10,000 population, the Illinois Northern Utilities Company has been very successful in closing street-lighting contracts for both standard and ornamental street illumination as follows:

When renewing its regular contracts the company has found that usually a few of the local merchants want ornamental posts. These it has advised to take up the matter of ornamental lighting with the city while a new contract was going through and the municipality might be willing to undertake the installation. Such a plan of having the city defray the cost is in any case, according to Mr. C. B. Yonts, general contract agent at Dixon, Ill., much more desirable than the method sometimes followed of dividing the expense among the merchants.

The interested merchants then agitated the question and made up parties to visit installations of ornamental lighting in nearby cities at their own expense. The company got them to call a meeting with the city officials, at which plans were submitted showing the total cost of the installation and the maintenance of the posts, the merchants to pay the cost of the installation and the city that of lighting and maintenance. The figures that were submitted were made in conjunction with the regular street lighting, which is taken for a ten-year period, thus placing the ornamental lighting on a permanent basis.

At Forreston, a town of 900, where the company installed twenty three-lamp posts, the city paid for the total installation and the lighting of the lamps. In Amboy, a city of 2500, the merchants paid for the posts and the city for the lighting. In other small towns the municipality paid half the cost and the other half was raised by means of public subscription.

One lesson learned from the contracts taken in this way was that it is always best to let the merchants do most of the talking. Indeed, more contracts were closed in this way with less effort than for any other class of business. In one town the president of the village board "signed up" every donation himself. In another town a newspaper man, with one of the largest merchants, raised the entire amount necessary for the installation.

The Approach of Electric-Ironing Days

In attractive advertisements in the local newspapers the Union Electric Light & Power Company of St. Louis, Mo., is carrying on a campaign of reminders to its customers

$3.50
Summer Time
will soon be here
There is more ironing done in a week in summer than in a month in winter
Remember this about the
Electric Iron
It is efficient, economical and convenient. Saves time, saves steps, saves fuel, and
nothing gets hot but the iron
You can order one on thirty days' free trial
at our Show Rooms
12th and Locust Streets
4912 Delmar Avenue
3012 S. Grand Avenue
3928 N. Grand Avenue
ELECTRIC SERVICE

CENTRAL-STATION COMPANY'S TIMELY ADVERTISEMENT

and prospective patrons lest they forget that the glorious days of summer will soon be here when the electric iron will be in the height of its usefulness. More ironing is done in a week in summer than in a month in winter notwithstanding the fact that ordinary means for heating non-electric irons usually go out of service with the approach of the hot days.

The electric flatiron therefore becomes the logical appliance for use. It is efficient, economical and convenient. It saves time, steps and fuel, and, in the words of the St. Louis company's advertisement, "Nothing gets hot but the iron." The Union Electric company offers to furnish these irons on thirty days' free trial if desired.

Six-Ton Ice Plant a Valuable Auxiliary

That even a 6-ton by-product ice plant may be a valuable addition to a small central station is shown in the figures presented by the general manager of an ice-electric plant in Georgia. During the ice man's busy season this industrious manager has succeeded in marketing 1500 tons of ice, which is quite a remarkable record for a town of 1000 inhabitants.

Steam compression apparatus is used for handling the ammonia. The total investment, including the buildings and refrigeration plant, is given as about $10,000. A statement of the yearly operating expense is made as follows:

Fuel	$750.00
Labor, including office	400.00
Miscellaneous	50.00
Delivery	280.00
Total	$1,480.00

It is estimated that the price of producing 1 ton of ice at the platform is $3.60. The ice which was sold from the platform in wholesale lots was disposed of at $4.30 a ton. Deliveries were made to small customers at $8 a ton. One wagon was found adequate to supply the retail trade.

The statement of this firm's annual receipts and disbursements from its ice business follows:

Yearly gross income for ice business	$2,250.00
Yearly expenses (including depreciation, interest, etc.)	1,730.00
Net income	$520.00

These figures show that the ice plant has earned in excess of 5 per cent per annum, a showing of an entirely satisfactory nature.

Handbook of Central-Station Service

The revised or 1913 edition of the "Handbook for Users of Central Station Lighting and Power Service," issued by the Commonwealth Edison Company of Chicago, contains much useful information for customers. The user is told how to obtain electric service, what the rates are, how to read the meters and how bills are figured and receives other information in relation to incandescent lamps, repair service and the company's display rooms. At the end are a few questions and answers explaining in a simple manner the most common terms relating to the business, such as "kilowatt-hour," "alternating current," "cycle," "load-factor" and the like. One excellent feature is an explanation showing why it is not practicable to charge for electricity at a uniform rate regardless of how or when it is used. The pamphlet is of convenient size to slip into a coat pocket and contains thirty-two pages bound in a cover.

Moving-Picture Publicity at Brattleboro, Vt.

Popular interest in central-station service at Brattleboro, Vt., was recently stimulated by the "electrical matinees" given at a local moving-picture house by the Twin State Gas & Electric Company. Advertisements announcing the performance had been run in advance in the local papers, and on the day preceding the exhibition printed invitations were sent out with admission tickets.

The program opened with a brief address by Mr. C. M. Addis, manager of the company, who spoke in popular language concerning electricity and its applications in the home, office and factory. He then exhibited four semi-humorous moving-picture films loaned by electrical manufacturers, interspersing them with the regular entertainment films obtained from a motion-picture agency. These were followed with lantern slides especially prepared for this matinee, including charts showing night and day service hours, etc.

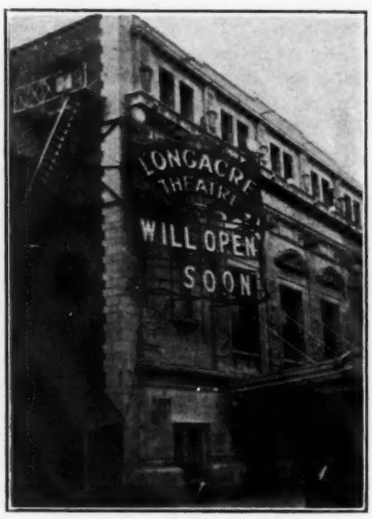
On the stage was placed a display of electric cooking and heating appliances, where their use could be actually demonstrated. Mr. Addis had a loaf of bread ready to bake and put this into an oven and baked it before the audience. He also made coffee, cooked eggs and browned toast, meanwhile quoting rates and prices.

Mr. Addis had expected an attendance of about 300 householders, as he held the matinee on Tuesday when children were in school and servants normally at home. The moving-picture theater seats 560 people. But when 750 tickets had been turned in at the door the town policeman refused to allow any more to enter, and some fifty to sixty people were turned away. The rental of the theater cost $15 for the performance.

Officials of the Twin State company are confident that this electrical matinee will be helpful and influencing for three to five months, at which time it may be advisable to repeat the performance. The interest manifested on the part of the public, as shown by the questions asked, was quite amazing and shows how far the electrical industry has yet to go before reaching the saturation point.

The Electric Sign as an Advance Agent

The prospective user of an electric sign should not lose any time waiting until his new building or quarters are completed before installing and operating his display. If he does thus postpone putting up the sign after there is enough of the structure completed to carry the weight, he will be losing a valuable advertising potentiality. In the weeks preceding the completion of a new building an electric sign will impress on the minds of the public the nature and indentity of the future business, doing this at a time when the natural curiosity and interest of the public will be appealed to.



ELECTRIC SIGN OPERATING AS BUILDING IS UNDER CONSTRUCTION

At all events, the sign display should be got into place at the first possible opportunity, and then, when the structure is later finished and opened for business, there will already have been fixed in the public mind a full understanding of the new undertaking. The start obtained in this way may prove valuable in establishing the new business during the trying initial period of getting under headway, thus reducing what utility appraisers call "the cost-of-going value." In the accompanying illustration is shown the display of a new Times Square theater in New York City, whose electric-lighted sign has been up, and burning nightly, for weeks in advance of the actual opening of the playhouse.

Electric Pole Truck

The distribution of wooden poles has always been one of the most troublesome problems confronting the transportation department of the Philadelphia Electric Company. This has become more serious in the last few years, owing to the rapid increase in the use of excessively high poles due to the extension of high-tension transmission lines, which necessitates the placing of such wires over the wires of all other companies and over railroad crossings at a clearance not less than 30 ft. above the rails. It has been the practice of the Philadelphia Electric Company to distribute such poles by the use of horse-drawn trucks the rear wheels of which are rigid, and for this reason turns of large radius have been necessary.

Some of the poles used in the work are 90 ft. long and are very difficult to handle in congested sections of the city. In making turns consideration must be given not only to the length of the poles but also to the space occupied by two or more horses in tandem—sometimes the length of street occupied by the loaded vehicle and horses is as much as 130 ft.

For a number of years the construction of an electric truck has been under consideration which would embody the following advantages: the space occupied by the loaded truck to be limited to the length of the poles, this to be accomplished by allowing the poles to overhang at both the front and rear ends; ability to turn in a comparatively small circle; ability to cover more ground at a greater speed than a horse-drawn vehicle; construction such as to permit of the loading and unloading of poles by electricity. All of these advantages are embodied in the new truck shown herewith and built by the Commercial Truck Company at the suggestion of Mr. A. H. Manwaring, head of the arc-lighting department of the Philadelphia Electric Company.

The devising of a satisfactory method of steering such a long vehicle proved to be quite a problem. It would be a simple matter to control all the wheels from the driver's position, but under such conditions the front and rear wheels would turn in opposite directions. This would not be satisfactory in a pole truck, because of the fact that poles are unloaded at the curb line, and in getting away from the curb, while the front wheels would leave, the rear wheels would run into the curb. The control of the rear wheels by an upright standard and an additional steering wheel was also impracticable, for the reason that this arrangement would prohibit the loading and unloading of the poles from either side of the truck. All these difficulties have been overcome in the present design, which provides for the steering of the rear wheels from the side of the truck by an apparatus so arranged that it can be locked when the wheels are in a neutral position. This enables the truck to be controlled entirely by the front steering mechanism, the rear steer being used only when short turns are necessary.

On account of the greater weight on the front wheels when the truck is running empty the brakes were made to operate on the front wheels, as well as on the rear wheels, in order to eliminate any tendency to skid.

The loading and unloading of poles is accomplished by an electric winch in the center of the truck. This winch is wired so that it can be controlled from switches under the seat or from either side of the truck at the motor, and when in operation the control of the truck itself is cut out. By this winch it is possible to place poles in any position on the truck, and even when the truck is partially loaded additional poles can be placed at the top of the pile. This is particularly advantageous inasmuch as it is only necessary to detail two men (a driver and a helper) with the truck when loading or unloading poles, which can be done much more rapidly than has been practicable with four men heretofore.

The truck itself is of 6 tons capacity and weighs, when unloaded, about 12,000 lb. The division of the unloaded weight is 60 per cent on the front wheels and 40 per cent on the rear wheels. Calculations have been made showing the positions to be occupied by the various lengths of poles on the truck, in order that the load may be equally distributed between the front and rear wheels.

The truck is fitted with four-motor drive, which is necessary in order to provide proper traction for such a long wheelbase. The batteries (forty-two-cell, twenty-one-plate "M.V. Exide") are placed in a compartment under the bed of the truck in front of the center. A compartment to the rear of the center is utilized for carrying tools, such as cant hooks, jacks, short skids, rope, etc.

ELECTRIC POLE TRUCK WITH FOUR-MOTOR DRIVE

A number of interesting features of the truck are as follows: The weight of the steel used in its construction is 5750 lb.; the weight of the rubber in the tires is 1750 lb.; the length over all is 31 ft. 6 in.; the wheelbase is 20 ft. With the rear wheels locked in the neutral position the truck will turn in a radius of 40 ft. By using both front and rear steering wheels the truck will turn in a radius of 18 ft. The truck can cover approximately 30 miles at full load. Its speed on the level is approximately 7 miles per hour at full load. The four-motor drive will enable the truck to wend its way through almost any condition of roadway, and on trial it successfully carried a full load up a 9 per cent grade.

The new truck has also a decided advertising value. The name of the company is conspicuously displayed as well as the company's motto, "If it isn't electric it isn't modern!" Innumerable questions have been asked regarding the operation of the truck and it has done a great deal to attract the general public to the use of electric vehicles.

Illumination and Wiring

Testing Shadow Effects of Various Systems of Lighting

In a paper read before the Illuminating Engineering Society of London by Messrs. J. G. Clark and V. H. Mac-

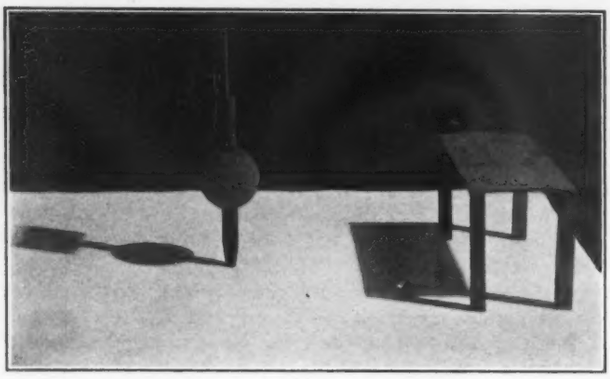


FIG. 1—SHADOWS CAST BY OBJECTS LIGHTED BY SINGLE DIRECT UNIT

kinney an attempt was made to define the main functions of a shade or reflector. One quality which is sometimes forgotten is the softening of shadows. A so-called "harsh" or "hard" system of lighting is usually one in which abrupt shadows are cast by a lamp owing to the light not being spread over a sufficient area. It is well known that very soft shadows are cast by indirect systems of lighting, although it would be incorrect to term the illumination shadowless. Although a great deal of discussion has raged around the shadow effects of direct and indirect systems of lighting, very little effort seems to have been made to define shadows and to represent by models and experiments what the effects of various systems of lighting in this respect will be.

In the paper by Messrs. Clark and Mackinney an interesting method of exhibiting shadow effects was described. A standard object, consisting of a rod having on it a sphere and a flat disk, was mounted on a piece of white paper and photographs of the shadows with various systems of lighting were taken. Figs. 1 and 2 show the nature

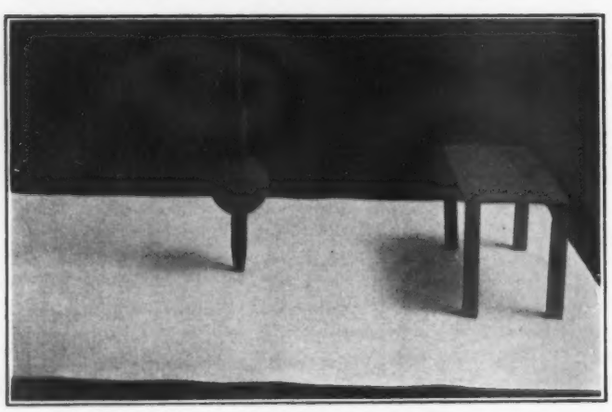


FIG. 2—OBJECTS LIGHTED BY SINGLE INDIRECT UNIT

of the shadows cast respectively by a single direct and a single indirect unit placed in the center of the room.

By taking an object of standard dimensions and subjecting it in turn to each system of lighting to be studied, and subsequently taking photographs of the shadow produced, much useful information about various systems of lighting might be obtained.

Indirect Lighting on Limited Trains Between New York and Boston

One of the most striking features of the Merchants' Limited five-hour trains between New York and Boston on the New York, New Haven & Hartford Railroad is the use of indirect electric lighting on new rolling stock recently purchased and installed for this service. The cars are of steel construction and represent in finish and appointments the perfection of the car builder's art, consisting in the case of each train of four parlor cars, a combination parlor and baggage car and an observation smoker, with the usual dining-car equipment. The lighting is provided by an axle generator and auxiliary storage-battery installation on each car, with automatic voltage regulation standardized for 32 volts operation.

The accompanying photographs illustrate the interior of the observation car and of one of the standard parlor cars. The length of the observation car inside sills is 71.5 ft., and it contains seating accommodations for fifty-four passengers, the main aisle being flanked by two rows of twenty seats each. Seven indirect lighting fixtures are provided in the observation section, each containing three 50-watt tungsten lamps suspended vertically above a white porcelain reflecting bowl 16 in. in diameter and carried in a solid bronze lacquered dome hung 7.5 ft. above the floor. Three

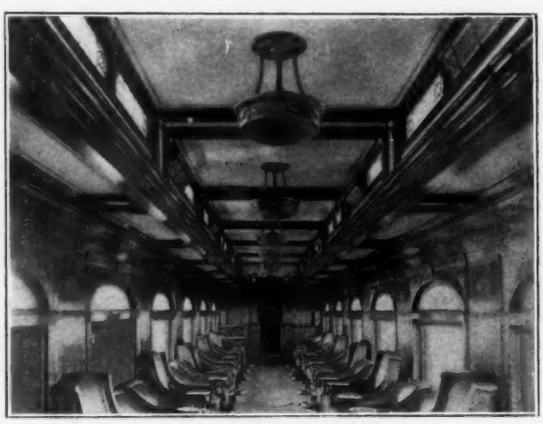


FIG. 1—LIGHTING UNITS IN OBSERVATION CAR

additional fixtures are provided, one for the drawing-room or rathskeller section of the car and one at each entrance into the car from the vestibule. The monitor is about 5 ft. wide and is finished in a light cream color. The fixture is hung so that the reflecting bowl is about 12 in. below the monitor ceiling, the fixtures being spaced 6.5 ft. apart on centers and installed in a single row. No side lighting is required. The interior finish is in cocoa-wood and a buffet in which water can be heated electrically is attached to this car.

The parlor cars are of the same length as the observation smoker, each having thirty-six chairs upholstered in a rich rose-colored tapestry. The seats are installed on centers 42 in. apart and are about 17 in. above the floor, the aisle width being 28 in. The inside length of the parlor car between bulkheads is about 62 ft., and in this distance ten indirect lighting fixtures are provided, each containing a 100-watt tungsten lamp mounted vertically above the inverted reflecting bowl. The latter is carried in a bronze receptacle as in the observation car, and the general dimensions are approximately the same in each case. Outside the bulkheads at each end an additional fixture is installed to illuminate the approach and exit between the car interior and the vestibule. The fixtures are about 9 in. deep.

The dining cars on these trains are 73.5 ft. long over sills and are each fitted with twelve tables seating four passengers each, the tables being on centers 6.5 ft. apart and

being 2 ft. 9 in. x 41 in. in size, carried 29 in. above the floor. Six fixtures, each with a 100-watt tungsten lamp, are provided, the fixture spacing being 6 ft. 5 in. and the height of the bottom 7 ft. 4 in. above the aisle. The fixture dimensions are about the same as in the other cars, and there is a monitor 5 ft. wide at the top, with light cream-colored finish to reflect the light downward from the fixture. The side walls of the dining cars and the parlor

FIG. 2—PARLOR CAR ON LIMITED TRAIN

cars are finished in Mexican mahogany, with a cream-colored border above the window spaces. The cost of each dining car was about $30,000 and of each parlor car about $20,000. The lighting of the combination parlor car with baggage compartment is similar to that of the other parlor cars, but a smaller total number of fixtures is required. The lighting effect throughout the train is soft and pleasing, without the slightest glare, and the finest print can be read with ease. Preliminary observation indicates, however, that the 150-watt fixtures are giving better satisfaction than the 100-watt outfits, and it is probable that the former will take the place of the latter, as the substitution can easily be made without altering the fixture itself. The plans for the installation provide for approximately 4 to 4.5 ft.-candles on a working plane 33 in. above the floor. These trains are believed to be the first in the world to be equipped with indirect lighting.

Recodification of Denver Electrical Ordinances

The city of Denver, Col., has just recodified its electrical ordinances, including in the new measures much that is helpful for the wireman.

Conduit is required for all new work in all classes of buildings, except that metal molding can be used in exposed work, while for fished wires in rewiring jobs flexible-steel armored construction may be employed.

Motors with commutators and brushes must either be of the inclosed type or have the openings in their frames tightly covered with metal, unless they are installed in separate motor rooms not in garages, dry-cleaning or similar establishments having cement floors. The Minneapolis rules for size of motor leads and fusing have been embodied in the new Denver code.

Neutrals must be grounded at each service. Vapor-proof globes must be used on all lamps in dry-cleaning establishments and paint and varnish works. The standard conduit and wire table published by the National Electrical Contractors' Association has been adopted as the requirement of the city.

The use of standard symbols for wiring plans, as published by the above-named association, is required on all wiring plans submitted to the city electrician.

The new Denver ordinance code resulted from conferences between Messrs. John Malm, city electrician, of Denver; C. B. Thorn, assistant city electrician; W. J. Canada, engineer of the Rocky Mountain Fire Underwriters' Association, and a committee of the local electrical contractors.

Recent Telephone Patents

Automatic Devices

A patent has been granted to Mr. William Kaisling, of Chicago, on a sender for automatic systems, and a second patent has been granted to him for a desk-stand instrument adapted to include this sender. This sender mechanism is included in the base of the desk stand. Finger-holds are provided for the various digits, each being mounted individually to revolve a slight distance upon the mounting stud. Each finger-hold is thrown against its back stop by a spring and is arranged along an arc whose center is practically coincident with that of the desk stand. The angular movement of this arc, in response to a pull, corresponds to the digit associated with that finger-hold. The movement is limited by the engagement of the arc with a stop-pin, and this engagement is only effected during pressure on the finger-hold. When the pressure is released, the arc returns to its normal position, the sending mechanism operating to send out the required number of impulses. These patents are assigned to the Kellogg Switchboard & Manufacturing Company.

Mr. C. R. Austin, of Los Angeles, has also invented a device in which the sender is returned to its original position by electrical impulses rather than by a spring. The numbers are arranged upon a perforated dial over which the sender lever travels. The lever is set in the desired position, a pin in its extermity engaging the proper hole in the dial. The mechanism is released by depressing an auxiliary key whereupon a vibrating relay sets up a series of impulses which operate simultaneously upon the central office switch of the sender, stepping the one forward and the other back. If a busy line is encountered, a lamp is lighted to denote this. If a busy line be not encountered, ringing takes place automatically.

Letters to the Editors

High-Frequency Alternator

To the Editors of the Electrical World:

Sirs:—In an article in the *Electrical World* dated April 5, entitled "Electromechanics Research Laboratory of Columbia University," by Prof. J. H. Morecroft, reference is made to a "General Electric high-frequency alternator." Allow me to give a brief history of the development of this machine. The first high-frequency alternator to operate at a frequency above 10,000 cycles per second was designed by Prof. R. A. Fessenden, the machine being built to run at 30,000 r.p.m. and give a frequency of 75,000 cycles per second. Professor Fessenden attended to the construction of this machine in the shop of the National Electric Signaling Company. The machine was directly connected to a 30,000-r.p.m. De Laval turbine. Finally, after much work in developing armatures of the multi-segment type (the original ones warping against the disk), in accurate balance of the disk, in cutting down air friction, etc., the generator was completed. It is ready to run to-day, after having been in service for five or six years, during which time not a single trouble of any consequence has ever been experienced with it.

It was found necessary to build a motor-driven alternator after the same plan as the turbo-driven machine, and in

order to get the required speed—in this case 20,000 r.p.m.—it was decided to use De Laval gears. These gears are the same as are used to reduce the speed from the De Laval turbine to the generator it drives. We decided to use them to increase the speed of the generator above that of the motor.

The facilities in the shop of the National Electric Signaling Company not being adequate for manufacturing the machines commercially, the work was given to an outside shop, in this case that of the General Electric Company. The General Electric Company proceeded to build the machines along the lines of the former Fessenden generators.

The above is a brief history of the machines now referred to as the "General Electric high-frequency alternators."

D. R. Price,
Formerly Chief Engineer National Electric Signaling Company.

Pittsburgh, Pa.

To the Editors of the Electrical World:

Sirs:—Quotations on the high-frequency alternator in the laboratory at Columbia University were received from the General Electric Company, and after the bid was accepted that company furnished an alternator built at Schenectady and bearing a General Electric Company name-plate. From any possible standpoint, the machine is as much a General Electric alternator as is any other alternator built by the company.

J. H. Morecroft,
Department of Electrical Engineering, Columbia University.

New York, N. Y.

[The history of the development of the high-frequency alternator was outlined by Mr. E. F. W. Alexanderson, in a paper entitled "Alternator for 100,000 Cycles," presented before the American Institute of Electrical Engineers on June 28, 1909. In this paper the author stated that his work of development had been undertaken for Professor Fessenden in 1904. Several publications by Mr. Alexanderson and Professor Fessenden show that they have cooperated in the development work since that time. In an A. I. E. E. paper presented on Nov. 10, 1911, Mr. Alexanderson described an alternator giving 200,000 cycles per second, probably the highest frequency ever obtained directly from a generator.—Eds.]

Magnetization and Weight

To the Editors of the Electrical World:

Sirs:—Many puzzling physical phenomena can be defined in simple terms by the electronic theory, although sometimes it is hard to reconcile some of these varied explanations with each other. Two interesting cases, for example, are the electronic explanations of gravitation and of magnetism, to which recent reference has been made in the *Electrical World*.

In magnetized materials, we are told, the spinning solar systems of electrons are more or less polarized in direction so that the charges, moving in parallel-plane orbits, set up perceptible magnetic effects in the mass—just as would similarly circulating currents to which the moving charges can be compared.

Turning to the pleasing electronic theory of gravitation as presented by Dr. Crehore in your pages several months ago, we are there given to understand that any negative electron, sweeping in planetary fashion around its positively charged principal, exerts its electromagnetic-gravitational pull chiefly on such other atoms as are near the plane of its orbit, the effect decreasing to zero as the line of the axis of rotation is approached. Since, however, the hundreds of electronic planets in a given atom probably revolve in as many different planes, and since the atoms themselves are very likely disposed higgledy-piggledy in ordinary matter, we find gravitation occurring in identical degree in all directions about a given mass.

Now, if this gravitational hypothesis be true with respect to the individual electron, and if it were possible with a powerful magnetic field to polarize some of these electronic solar systems, we ought to get increased gravitational attraction along the common plane of rotation, while at the axis this force should be correspondingly enfeebled. We should then have the anomaly of a body which weighed more on one side than on another.

But, from the magnetic explanation already cited, do we not, in magnetized iron or other material, have exactly such a polarized condition of the electronic systems? Putting a bar of magnetized steel to a practical test, will careful measurements show a minimum gravitational pull along its magnetic axis? And at right angles to its length will the mass attraction be greater than that of an unmagnetized piece?

If, despite the obvious observational difficulties, evidence could be found of such a diminution of gravitational pull in the region of greatest magnetic activity, certainly both of the present interesting electronic explanations of gravitation and of magnetism would receive very direct substantiation—of which, by the way, they are still in some need.

F. Russell Weed.

New York, N. Y.

Prevention of Accidents

To the Editors of the Electrical World:

Sirs:—The article in your issue for March 22, referring to a paper by Mr. D. D. Lescohier before the Minnesota Electrical Association on March 11, is of much interest to me. I agree with the author that "linemen appear to be the greatest sufferers." It is quite true that most of the accidents are due to contact with wires in close proximity to the lineman while his mind is intent on "making up" joints on which he is working. The cure for this kind of accidents, however, is not by holding the foreman "rigidly accountable for use of protective devices," nor is it true that he "holds the key to the situation and on him should the responsibility be concentrated." The gang foremen are placed in a peculiar position in that they rarely have opportunity to choose the safety appliances they are to use, to dictate the standard of construction to be employed, the pin spacings with relation to pole or the weather conditions they are to work under; nor can they "kill" a line to make repairs, or direct what position dangerous dead-grounded lead cables or telephone wires are to occupy with relation to the live primary wires or what relation the local primary distribution system main is to occupy with relation to the secondary distribution mains.

Many companies insist on putting primary and secondary wires on the same cross-arm, thereby compelling the men to work in dangerous positions 90 per cent of the time because of the extra expense of separate cross-arms. The engineer who determines the standard of construction and holds the job of the foreman in the palm of his hand is the man to be "rigidly accountable for the use of protective devices," and this plan would result in proper safety in standard of position and operation methods. One should provide safe rules under which a man can work, not rules for legal protection. One should sectionalize the branch mains so that sections can be cut out as suggested by Mr. H. J. Gille, of St. Paul. The lineman should be called into the "family group" and a few experience meetings should be held. If safety is put above the dollar, accidents will be reduced and the volume of work increased, with a consequent reduction in the labor cost.

John L. Fay.

St. Louis, Mo.

Field of the Operating Engineer

A Record of Practice, Experience, New Ideas and Interesting Problems—Notes on Practical Subjects—Questions and Answers

Pipe Choked with Scale and Foreign Matter

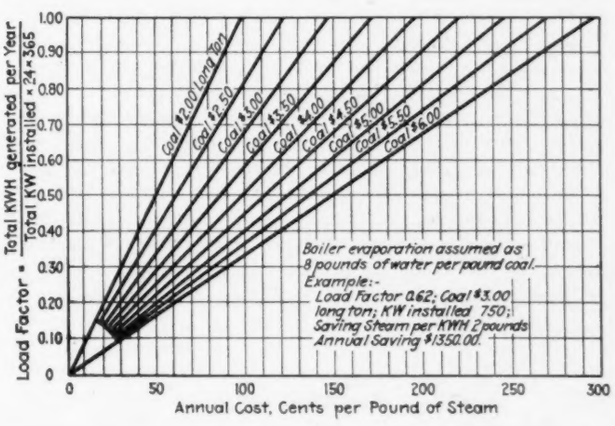
The importance of inspecting boilers periodically and thoroughly is well illustrated by the feed pipe shown in section from a photograph taken by one of the well-known accident insurance companies. This pipe was neglected and became choked with stony scale until the free opening through it was only 5/32 in. in diameter. The necessity of frequent inspection of pipes is keenly appreciated along the seacoast cities, where it not unfrequently happens that the circulating water intakes for the condensers are found choked with seaweed and barnacles, even in cases where screens have been provided with them.

CROSS-SECTION OF PIPE

Steam Economy Versus Dollars

Frequently the purchaser of a steam engine or turbine is not alive to the enormity of the loss which may be occasioned from poor steam economy in the prime mover. In order to demonstrate more clearly the advisability of securing the lowest steam consumption possible and to enable the prospective customer to associate a real money value with each pound of steam saved, an enterprising salesman has prepared the accompanying set of curves.

With the aid of this chart and a knowledge of the load-factor and the cost of coal at the plant in question, only a simple arithmetical calculation is necessary to arrive at the annual plant saving with any condition of decreased steam consumption. For example, the load-factor at a certain 750-kw plant has been found to be 62 per cent, and coal



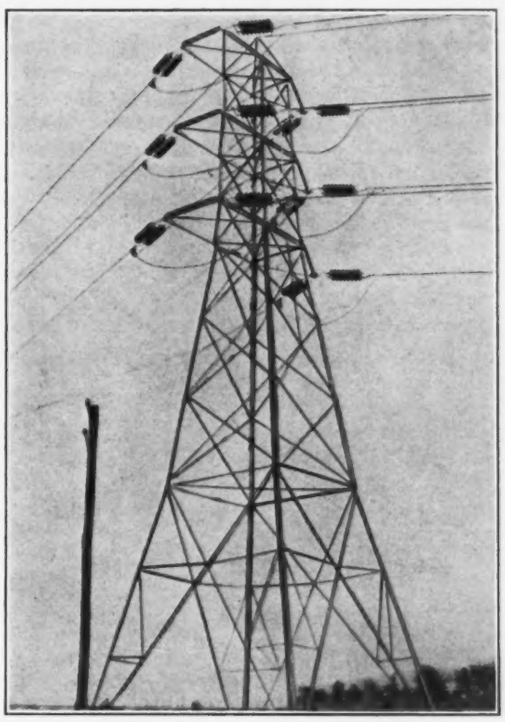
CURVES FOR CALCULATING SAVING FROM INCREASED STEAM ECONOMY

may be bought at $3 a long ton. Tracing a horizontal line through the point marking 62 per cent load-factor to intersect the curve bearing the legend "coal $3," and reading the ordinate of this point, it is found that the annual cost per kilowatt of generating 1 lb. of steam is 90 cents.

If the proposed installation is to save 2 lb. of steam per hour per kilowatt installed, it is readily seen that the total annual saving will be $750 \times 2 \times \$0.90 = \$1{,}350.00$. To the man who is contemplating the installation of new apparatus such a graphic and forcible presentation of facts as this cannot fail to carry home its point.

Construction Methods on Keokuk-St. Louis Transmission Line

The 110,000-volt transmission line which will convey to St. Louis the output of the great Keokuk water-power plant 144 miles distant is made up of six 300,000-circ. mil copper



KEOKUK TRANSMISSION TOWER, SHOWING INSULATORS AND JUMPER WIRES

cables, each 5/8 in. in diameter. Suspension-type insulators, each consisting of seven 10-in. disks, carry the unusual weight of this conductor, which is strung in spans of 800 ft. each. The cable has an ultimate strength of 14,000 lb., and as strung the maximum tension, even when coated with half an inch of ice in a 60-mile gale, will be little over 7000 lb. Linking the 79-ft. steel towers is a 0.5-in. galvanized seven-strand Siemens-Martin cable used as a ground wire.

Owing to the very great weight of the 300,000-circ. mil conductors, the methods of erecting the towers and cables are of interest. The towers were assembled complete on the ground and raised with a temporary hinge fastened to two of the foundation piers, by means of a gin pole and a team of horses. The conductor was next strung from one angle tower to the next in one operation. This was accomplished by hanging pulleys from the towers at points

where the insulators would ultimately be placed, threading the cable through these and pulling it up for the entire distance between anchor towers. It was brought to the proper tension by means of a dynamometer or heavy spring scale and then fastened to the dead-end insulators at each end. A stirrup support was next attached at each tower, the conductor raised from the pulley by it, the pulley removed and the insulator hung and bolted to the cable.

The insulators which support the high-tension conductors are of exceptional interest. They consist of seven corrugated porcelain disks, each 10 in. in diameter, mounted in a string by means of malleable-iron fittings which are cemented to them. These insulators were selected after a large number of tests of various types at the highest voltages that had been used for that purpose, and an insulator was finally devised which affords a safety factor greater than that employed on any other transmission system of like voltage. The completed insulator unit, 3 ft. in length, withstands a pressure test of 440,000 volts under ordinary conditions, and even in a driving rain this is reduced by only 25 per cent.

The insulator is held to the tower and the conductor to the insulator by fittings of open-hearth steel. The fitting for the latter purpose, called the wire clamp, consists of two plates into each of which a wavy groove, flaring at the ends, has been pressed. These are bolted together around the wire and the waves serve to produce the necessary friction for holding it. A large cable of this kind must be held so that none of the small individual wires will be mashed in the clamp or over-strained by sharp bends at the ends of the clamp, and much careful investigation was necessary before this type of clamp, which holds the wire firmly and yet does not injure it, was devised.

Operation of a Turbo-Electric Ice Factory

A turbo-alternator will be used to generate electricity for operating the motor-driven compressors and other machines of a new ice and cold-storage plant now being erected for the American Refrigerating Company at Los Angeles, Cal., the condensate reclaimed from the turbine being used as the source of distilled water for ice making. Heretofore there have been installed in various parts of the country a number of electrically driven ice plants, but in most of these instances the central-station electric drive employed has generally been used for making only "raw-water" ice, no steam machinery being installed.

To make distilled-water ice, the standard practice has been to connect a Corliss engine directly to the ammonia compressor and to use steam-driven auxiliaries for miscellaneous purposes about the plant. Steam condensed from all these sources, usually in a condenser open to the air, is then re-boiled to drive off the air, being skimmed at the same time to remove oil and grease. To make distilled-water ice by the ordinary process requires therefore a waste of distilled water, in skimming, of from 10 per cent up and involves the use of inefficient steam auxiliaries.

In the Los Angeles plant referred to, now under construction by Hoxie & Goodloe, of New York and Los Angeles, all power used is to be furnished by a turbo-generator, the ammonia compressor as well as all auxiliaries being motor-driven. Even the power required to move the ice wagons will be made to yield its quota of distilled water, since ice delivery is to be entirely by electric trucks, charged with energy furnished by the turbo-generator. The reasons that led the engineers to such a radical departure from existing practice were, in addition to those already enumerated, the desire to produce ice of unapproached purity by keeping oil out of the steam to begin with, to produce a plant requiring a minimum amount of labor for its operation, to get the same efficiency from the auxiliaries as from the main units, and to keep this efficiency high for the entire plant.

Following through the course of the water, the supply, coming from an artesian well, is passed through a purifying system and goes through an open type of feed-water heater, in which the water is not only heated to boiling but is actually boiled for some minutes in order to drive off the dissolved gases that otherwise would interfere with the transparency of the ice, unless otherwise removed.

From the feed-water heater the feed water is delivered by an electrically driven triplex pump to the oil-fired Stirling boilers, operated at 160 lb. pressure. As steam it then passes to the turbine which drives a 60-cycle, three-phase, 440-volt General Electric turbo-generator. The exhaust steam from this unit rises to a special type of surface condenser located in a room directly overhead, in which also are placed the ammonia condensers, distilled-water tank, pre-coolers, etc. After being condensed, the condensate is led through a specially designed re-boiler, in which any remaining gases are driven off. These gases and the vapors of re-boiling are carried back to the condenser and the gases removed by an electrically driven dry vacuum pump. The water from the re-boiler drops down through a barometric column and is pumped through the pre-coolers and filters to the storage tank and to the freezing cans.

The ammonia compressor is driven by a two-speed induction motor which can be changed from full speed to half speed, or vice versa, by a double-throw switch mounted on the motor. The rotor is wound six-phase, with six slip-rings, and the same controller is used to start the motor at either full speed or half speed. The main mechanical equipment may therefore be run at half output, but at very nearly the same efficiency during the winter months when the demand for ice is light, or, if desired, during the night time.

A flexible coupling connects the compressor motor to a pinion shaft running in three bearings rigidly fastened to the frame of the compressor. The compressor flywheel is made of semi-steel and has Wuest herringbone helical gear teeth cut in its face, which mesh with a pinion carried by the pinion shaft. Pinion and gears were made by the Falk company, Milwaukee, and the compressor by the Frick company, Waynesboro, Pa. The transmission losses between the motor and the compressor are believed to be materially less than between the cylinder of a Corliss engine and a similar compressor.

Electric motors are used for driving the circulating pumps, well pump, boiler-feed pump, dry-vacuum pump, brine tank agitators, ice hoist, etc., and a motor-generator set is provided for charging the batteries of the electric trucks which deliver the ice. The ice delivery trucks were purchased from the Baker Electric Company and are of 2 tons and 3.5 tons capacity. Exide batteries are used.

The performance of this plant will be watched with much interest, not only by electrical engineers, but by ice manufacturers generally, for if the plant fulfils its promise a new field will be opened for the steam turbine and the electric motor in ice-factory operation.

Lead Burning

Kindly inform me whether lead burning is done with a blowtorch or a charcoal fire and what kind of flux is used. H. M. G.

In lead burning as generally done use is made of neither a blowtorch nor a charcoal fire, but a needle-point hydrogen flame. As a rule the hydrogen generated is mixed with air and fed through a rubber hose to the burning tip. Under the action of this flame the lead surfaces to be joined flow together, and as lead is added from a stick in the hands of the operator the seam is filled by the process of amalgamation.

Digest of Current Electrical Literature

Abstracts of Important Original Articles Appearing in the Periodical Electrical Press of the World

Generators, Motors and Transformers

Commutation and Interpoles.—Ludwig Binder.—The emfs which according to the usual view are produced by the armature conductors cutting the so-called armature cross-flux are in reality produced by the transformer action of the linear short-circuit currents. The effect of the self-induction and the mutual induction of the armature conductors in the slots due to the linear short-circuit currents can be replaced in an exact manner by a field stationary in space which is cut by the rotating armature conductors. The form of this field can be found in a simple way from the number of conductors per slot and the time of commutation. This field is co-axial with the armature cross-field, but it runs across through the slots. The annihilation of the reaction voltage is, according to this view, due to the production of a flux-free zone in the slots (not on the armature surface), since the commutation field overcomes the slot cross-field which is also stationary. According to this view, therefore, it is not the emfs which compensate each other, but the fluxes.—*Elek. und Masch.* (Vienna), March 2 and 9, 1913.

Alternator Emf.—L. Klein.—G. Kapp gives the following formula for effective emf of the general alternating-current machine: $E = k\Phi nS \times 10^{-8}$, where n is the frequency, Φ the maximum number of the lines of flux from a pole and S the number of active armature conductors (rods) in series. The coefficient k is called by Pichelmayer the "Kapp factor," and Pichelmayer has given tables from which the Kapp factor for rectangular fields, for trapezoid fields and for sinusoidal fields can be easily found. The present author elaborates the formulas for sinusoidal fields still further with some references to the effect of higher harmonics in the case of turbo-generators.—*Elek. und Masch.* (Vienna), March 9, 1913.

Single-Phase Repulsion Motor.—A note on a recent British patent (No. 11,434, 1912) of the Oerlikon company. The motor has a shunt characteristic, and the direction of rotation is changed by shifting the magnetic axis. The stator winding is divided into groups connected in series, and part is reversible. Auxiliary brushes displaced 90 deg. from the short-circuited brushes are connected to the reversible stator winding. Arrangements are made so that the current in the working brushes is not reversed during the change-over. If a transformer is used to feed the auxiliary brushes, it is provided with a supplementary winding, through which the working brushes are constantly short-circuited.—London *Elec. Eng'ing*, April 3, 1913.

Starting Cascade Converters.—R. Johs. Jensen.—An article illustrated by diagrams giving the theory of the phenomena during the starting of cascade converters. The author shows that on account of the armature reaction in the converter synchronizing becomes difficult. By using starting induction coils synchronizing may be greatly facilitated.—*Elek. Zeit.*, April 3, 1913.

Lamps and Lighting

German Illuminating Engineering Society.—The official report of the first general meeting of the German Illuminating Society (Deutsche Beleuchtungstechnische Gesellschaft), held in the physical laboratory of the University of Berlin on Feb. 24, 1913. The meeting was opened by an address by Dr. Warburg, of the Reichanstalt. Professor Liebenthal reported that since the original meeting of the forty-eight charter members the number of members has increased to 212. Dr. Warburg was elected president. The board of directors consists of twenty-four members, of whom six must be also members of the German Association of Electrical Engineers and six others also members of the German Association of Gas Engineers. Dr. Lummer presented his paper on "The Eye and Illuminating Engineering." In the first part he discussed the physical aspect of the illuminating engineering problem and said that there are two ways of progress, one being toward light without heat and the other being an increase in the temperature of the body which gives out light. The second part of the paper dealt with the physiology of the human eye. Three committees were appointed, namely a committee on the light unit, a committee on nomenclature and a committee on measuring methods.—*Elek. Zeit.*, March 27, 1913.

Metallic-Filament Lamps Versus Arc Lamps.—A. Rossel.—A review of an extended discussion between representatives respectively of the arc-lamp industry and the incandescent-lamp industry as to whether high-candle-power metallic-filament lamps can replace arc lamps. The brilliancy of the arc lamp was given as a particular advantage, but from a hygienic point of view it is rather a disadvantage. Twenty-nine trolley-car motormen were asked to compare the lighting of two streets of equal lengths, one of which was lighted with 10-amp arc lamps and the other with 500-cp metallic-filament lamps. Out of the twenty-nine motormen twenty-five were in favor of the metallic-filament lamps. This is chiefly due to the irritation of the eyes of the motormen by the arc lamps, and incandescent-lamp lighting is said to reduce the number of accidents. The cost of operation was especially discussed. If the high-candle-power osram lamp consumes 0.8 watt per hefner candle and has a life of 1200 hours, the metallic-filament lamp is superior to a series of arc-lamp types. The superiority of the high-candle-power metallic-filament lamp is especially evident with alternating current. In the comparison of the two kinds of lamps the greater subdivision of the light in the case of the metallic-filament lamps is also to be taken into account, so that the same illumination is obtained with a smaller total candle-power with metallic-filament lamps.—*Schweiz. Elek. Zeit.*, Vol. 10, 1913, No. 5; abstracted in *Elek. Zeit.*, March 27, 1913.

Electric Lighting.—A. Steinhaus.—A review of the electric-lighting industry in Germany in 1912. He emphasizes the great progress of the metallic-filament lamp and states that although 5-cp, 110-volt lamps and 10-cp, 220-volt metallic-filament lamps are on the market, yet the 25-cp lamp should become the standard lamp for residences. The metallic-filament lamp has also been developed largely for advertising purposes. The Nernst lamp is used now only for physical purposes and as a projection lamp. The problem of the three-phase arc lamp appears to have been solved. Arc lamps in which pure carbon electrodes are used are continually losing ground in view of the advantages of impregnated carbon electrodes. Magnetite and titanium arcs, which are being used in the United States, have not been able to find a foothold in continental Europe. In connection with the mercury-vapor lamp the use of fluorescent reflectors, which is based chiefly on the use of

rhodamin, is not yet out of the experimental stage.—*Elek. Zeit.*, March 27, 1913.

Generation, Transmission and Distribution

Large Gas and Oil Engines.—Schoemburg.—The article points out that for electric-power plants the gas engine operated with producer gas is very satisfactory in large units. Very recently the large Diesel engine operated with tar oil has assumed a steadily increasing importance; for instance, in the new plant of Mannstädt & Company in Friedrich-Wilhelms-Hütte on the Sieg two Diesel engines, each of 2000 hp, will be installed which will operate in parallel with 440-volt direct-current gas units operated with blast-furnace gas.—*Elek. Zeit.*, April 3, 1913.

Installations, Systems and Appliances

Equalizing Voltage Fluctuations.—E. Beckmann.—The testing machines in the Institute of Technology at Hanover are being driven by direct-current motors supplied with energy from the network of the tramway system. Although shunt motors with lightly saturated fields are used, the voltage variations, which are between 420 and 520, are sometimes so large that the speed fluctuations may reach 11 per cent. In the course of a few seconds there are occasionally voltage fluctuations of 30 volts or more. For this reason it became necessary to install an automatic device for equalizing the voltage fluctuations. The arrangement is shown in Fig. 1. The direct-current supply from the tramway network is shown at *A*, fluctuating between 420 volts and 520 volts. *B* shows a 10-hp, three-phase synchronous motor operated from the lighting network *C*. This motor *B*, running at constant speed, drives the auxiliary machine *M* and the booster *N*. The booster *N* produces the additional or correction voltage which at any instant must equal exactly the difference between the normal voltage and the instantaneous value of the fluctuating voltage at *A*, so that at the point *X* the constant normal voltage is obtained. In order to let the booster *N* (which has a straight-line characteristic) always produce the voltage difference between normal voltage and instantaneous voltage at *A*, it is necessary that the magnetizing current in the field coils of *N* be proportional to the difference between normal voltage and voltage at *A*. For this purpose this voltage difference is impressed on the terminals of the excitation winding W_e of the machine *N*. This voltage difference is produced by opposing the constant normal voltage generated by the auxiliary machine *M* by the fluctuating voltage at *A*. A graphical method is given to show the most favorable value of the resistance of the winding W_e. The results of tests are given in diagrams.—*Elek. Zeit.*, April 3, 1913.

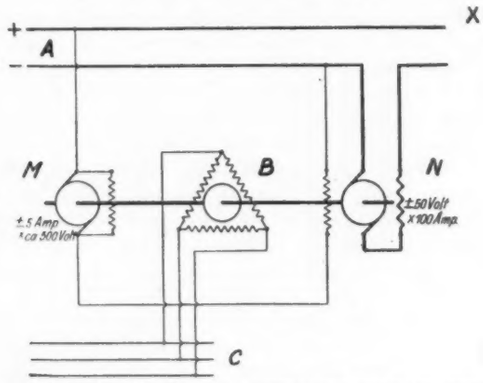


FIG. 1—CIRCUIT DIAGRAM OF AUTOMATIC VOLTAGE REGULATOR

Main Switch Gear.—B. Mittell.—An illustrated article in which the author deals with the importance of constructing main switch gear so that the chance of failure of supply is reduced to a minimum. The points discussed include the elimination of apparatus liable to breakdown and unsuitable material, the support of conductors, flame and arc-proof construction, ready isolation, and minimum interruption of healthy circuits.—London *Electrician*, April 4, 1913.

Warships.—A. P. Pyne.—A paper in abstract read before the New Castle section of the (British) Institution of Electrical Engineers on some special applications of electricity on warships.—London *Electrician*, April 4, 1913.

German Electrical Industries.—A continuation of the reviews of the status of the different fields of electrical engineering in Germany in 1912. C. Michenfelder discusses electric hoisting and transportation machinery, W. Phillippi the uses of electric energy in mining and metallurgy, Usbeck electric traction, V. Engelhardt electrometallurgy, and K. Arndt electrochemistry. This series of reviews is to be concluded.—*Elek. Zeit.*, April 3, 1913.

Wires, Wiring and Conduits

Calculating Networks.—Josef Herzog.—An article illustrated by numerous diagrams discussing several general superposition and subdivision principles for the calculation of complicated networks with many branches.—*Elek. und Masch.* (Vienna), March 16 and 23.

High-Tension Cables.—L. Lichtenstein.—An English translation in abstract of his German paper recently noted in the *Digest* on high-tension cables for the Dessau-Bitterfeld railway.—London *Electrician*, April 4, 1913.

Suspended Insulators.—E. E. Seefehlner.—An article pointing out that suspended insulators permit obtaining a high electrical and mechanical degree of safety with simple technical means. Comparative notes are given on the properties of several different types.—*Elek. und Masch.* (Vienna), March 23, 1913.

Electrophysics and Magnetism

Theory of Roentgen Rays.—W. F. G. Swann.—When a beam of X-rays or ultra-violet rays falls upon a thin sheet of metal, the values for the number and velocity of the beta rays produced are greater for the emergence beta rays than for the incidence ones. The explanation of this fact on the wave theory is generally considered to be attended by difficulties so serious as to necessitate the abandonment of the pulse theory in favor of a corpuscular hypothesis. Practically the same arguments which support the corpuscular theory for X-rays also support it for ultra-violet light, so that if the wave theory is abandoned for one, it is necessary to abandon it for the other. The author endeavors to show to what extent the want of symmetry in the expulsion of beta rays may be reconciled with the pulse theory, and also to discuss certain other points concerned with the properties of X-rays, etc.—*Philos. Mag.*, April, 1913.

Electrification Associated with Dust Clouds.—W. A. Douglas Rudge.—Nearly all kinds of finely divided material when blown into a cloud of dust by a current of air give rise to electrical charges upon the dust and upon the air. The nature of the charge resident upon the dust particles depends upon the chemical characteristics of the material. In general, the charge obtained upon the dust is opposite to that associated with the "ion" of the same substance when in solution, that is, strongly basic bodies give negatively charged dusts and strongly acidic bodies give positively charged dusts. In the case of salts the charge apparently depends on the relative strengths of the acidic and basic ions. Similarly constituted bodies give similar charges.—*Philos. Mag.*, April, 1913.

Brush Discharge in Water.—Harold Smith.—An account of a spectroscopic study of the electric brush discharge in water and salt solutions. The series spectrum of hydrogen in both the capillary and brush discharge increases with increase of current density, while the secondary spectrum decreases in relative intensity to the series lines. The series lines broaden considerably with the condensed discharges, and the relative intensity of the lines falls off toward the violet. The series spectrum of oxygen appears only with the higher-current density discharges, being

brighter with higher-current density. The elementary-line spectrum appears in the brush with the feebler discharges only, its brightness also depending on the nature of the solution. It appears in the spectrum of the capillary, in the capillary discharge, only very faintly, if at all, but in the discharge in dilute sulphuric acid it is the most important part of the spectrum of the bubble which forms at each end of the capillary. The lines of the metal of the dissolved salt appear in the brush. In the case of lithium their relative intensity varies with the salt used and also with the current. In weak solutions the metal lines are destroyed by the heavier condensed discharges. The metal lines appear very feebly in a capillary, and they are produced strongly only in the immediate neighborhood of a metal electrode. The spark-lines of platinum appear with the condensed discharges when a spark-gap is used.—*Philos. Mag.*, April, 1913.

Geissler Tube.—B. HODGSON.—An illustrated account of an experimental investigation of the temperature of the cathode and anode in a Geissler tube. There exists a linear relationship between the current through a vacuum tube and the heat energy communicated to the cathode both for normal and abnormal cathode glow. There exists a pressure at which this effect is a minimum. The ratio between the positive and negative carriers at the cathode is approximately ten to one. A linear relationship between current and heat energy exists at the anode, though for the same pressure and current the heat communicated is much less than in the case of the cathode. The anode fall alone is not able to account for the heat energy communicated to the anode.—*Philos. Mag.*, April, 1913.

Electrochemistry and Batteries

Conductivity and Fluidity of Strong Solutions.—W. S. TUCKER.—An illustrated (British) Physical Society paper in abstract. The author describes experiments made to find whether there is any relation between conductivity and fluidity. The feature of the method described is the simultaneous observation of temperature, viscosity and resistance. The electrolytic cell and viscometer are immersed in the solution for which they are employed, and both are bound to the bulb of a platinum thermometer, which serves also as a stirrer. The electrolytic cell *C* (Fig. 2) is a flattened tube drawn out into a flat jet. It contains a platinized-platinum electrode *P*, the dimensions of which are 25 mm by 5 mm. The second electrode, also of platinized platinum, forms a cylindrical sheath *Q* around the bulb of the thermometer *T*. The thermometer is mounted on a frame to which a vertical oscillatory motion is imparted. This motion is caused by a connecting rod attached to a large pulley driven by a motor. As the thermometer oscillates it draws through the liquid a platinum scoop, which acts as an efficient stirring arrangement. The resistance was measured by that modification of Kohlrausch's method described by Fitzpatrick in which a high-speed double commutator and a moving-coil galvanometer replace the coil and telephone. An accuracy of one part in two thousand could be thus obtained, which was greater than that possible with the viscosity apparatus. The results of tests of solutions of different concentrations are given. The viscosity is measured by a modification of Poiseuille's method. The tube through which the flow occurs is a uniform jet about 2 cm long, drawn out from a piece of quill tubing, *V*. Connections can be made by means of the side-tube *S* with an aspirator or with a compressed-air reservoir. When the tube is immersed in the solution the latter can be drawn in or driven out at will. The viscometer is plunged into the solution to a certain depth, and the time of inflow is measured and compared with that of water under the same conditions. During the experiments the viscometer is invisible, hence the levels of the liquids when flowing into the tube are indicated by electrical means. Two fine platinum wires, *A* and *B*, serve as contacts and are insulated from one another. As the liquid rises within the tube it makes circuit with *Q* and *A* through the liquid and the motion of a galvanometer is noted. A second motion is produced when contact with *B* is made. Thus the passing of the levers can be accurately timed. The assumption is made that the rate of influx of the solution is proportional to the hydrostatic pressure and inversely proportional to the viscosity.—London *Electrician*, April 4, 1913.

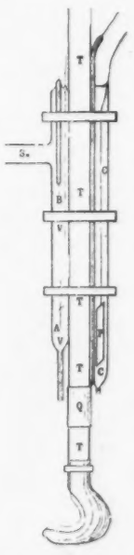


FIG. 2—APPARATUS FOR DETERMINING VISCOSITY AND CONDUCTIVITY

Units, Measurements and Instruments

Induction Watt-Hour Meter.—A. OHYA AND R. MITSUDA.—An illustrated mathematical paper on the characteristics of the induction-type alternating-current watt-hour meter. The authors give the characteristic equation of the watt-hour meter and discuss the voltage and load characteristics, the power-factor characteristic, meter testing and superposed error, and the effect of frequency.—Electrotechnical Laboratory, Dept. of Communications, Tokio, Japan, March 1, 1912; reprinted from the report of the first section of the Electrotechnical Laboratory, Tokio, Japan.

Demonstration of Oscillation Phenomena by Means of Resonance Curves.—F. KOCK.—A description of an arrangement by which resonance curves, as used for the investigation of oscillation phenomena, may be projected on a screen on a largely magnified scale. The arrangement consists of a bolometer bridge in connection with a moving-coil galvanometer of high sensibility and small period of oscillation and a rotating condenser which drives an oscillating mirror.—*Verh. d. Deutsch. Phys. Gesellsch.*, 1912, S. 701; abstracted in *Elek. Zeit.*, March 27, 1913.

Roentgen Photography.—F. DESSAUER.—A review of recent progress in Roentgen-ray photography. It is now possible to take a Roentgen-ray photograph in an exceedingly short time, so that photographs can be taken representing the different phases of any moving action of the human body, for instance, of the action of the heart, and can be assembled into the form of a moving picture.—*Archiv. f. physik. Mediz. u. med. Techn.*, Vol. 7, No. 2; abstracted in *Elek. Zeit.*, March 27, 1913.

Insulation Testing.—This continuation of the illustrated serial on shop testing of electrical apparatus deals with the determination of insulation resistance and dielectric strength.—*Elec. Journal*, March, 1913.

Testing Lightning Arresters.—E. E. F. CREIGHTON.—The author points out that in tests of lightning arresters no influencing factors of an unnatural character should be presented. He relates some tests that have been inappropriately applied to multi-gap arresters, and explains wherein they are wrong.—*Gen. Elec. Review*, March, 1913.

Testing of Cables by Direct Current.—J. DELON AND L. LICHTENSTEIN.—An English translation in abstract of their German paper recently noticed in the *Digest* on the use of direct current in cable tests.—London *Electrician*, March 14, 1913.

Power-Factor Indicators.—LEONARD MURPHY.—An article describing the principles of action of power-factor indicators and describing in detail the method of connecting up such indicators in single-phase and three-phase systems.—London *Elec. Review*, March 14. 1913.

Miscellaneous

Jubilee of the Electrical Society of Vienna.—The thirtieth anniversary of the foundation of the electrical society of Vienna (which is the national electrical engineering society of Austria) was celebrated on March 14 and 15. A full account of the various functions, including the principal festival meeting, a banquet and excursions, with reports of the speeches made, is given in *Elektrotechnik und Maschinenbau*, April 6, 1913. This journal, which is the official organ of the society, issued on this occasion a large and profusely illustrated festival number, in which after an introduction by the editor, J. Seidener, a review is given of the development of electrical engineering with special reference to Austria. F. Ross gives reminiscences of the early days of electrical engineering, E. von Rziha discusses the development of the electric-power plant, L. Kliment the development of heat engines, A. Budau the development of water-power plants, K. Pichelmayer the development of the design of electric machines, F. Patzelt the development of switches and circuit-breakers, F. Natalis the development of starting and regulating apparatus, A. Schwaiger the problem of regulating mechanisms in electrical engineering, E. Orlich the development of electrical measuring instruments and methods, J. Herzog the evolution of electric wiring calculations, J. Sahulka the situation of electric lighting, F. Niethammer the evolution of the electric drive of machines, P. Poschenrieder the development of electric railways, E. Wikander the domestic applications of electricity, H. Paweck the present status of the electrochemical industry, R. Franke telegraphy, telephony and signals, M. Reithoffer the evolution of wireless telegraphy, S. Jellinek electro-medicine and electro-pathology, F. von Guncsch the general situation of the electrical industries in Austria, J. Kareis the training of electrical engineers in Austria, and E. Adler the patent situation.—*Elek. und Masch.* (Vienna), Festnummer, March, 1913.

Book Reviews

Design of Electrical Machinery. Vol. II. Alternating-Current Transformers. By William T. Ryan, E.E. New York: John Wiley & Sons. 120 pages, illus. Price, $1.50.

This is a useful volume to be recommended to students who wish to obtain a general working knowledge of the design of alternating-current transformers. The methods employed are simple and rather general. The examples cited are typical, and they will help the student to acquire a working idea of the principles of transformer design.

Design of Electrical Machinery. Vol. III. Alternators, Synchronous Motors, Rotary Converters. By William T. Ryan, E.E. New York: John Wiley & Sons. 130 pages, illus. Price, $1.50.

The author treats the design of alternating-current generators, synchronous motors and rotary converters in a very elementary manner without particular emphasis upon general principles or fundamental ideas. His book is undoubtedly a useful one, adapted to the college courses, but it is a work in which one misses a broad scientific spirit. The examples of electrical machines are almost exclusively the product of one manufacturing concern, which fact, though it may not show much fault, is certainly apt to inculcate a certain narrowness of vision, however good the examples cited may be. The book may be heartily recommended to students at college, provided they accompany it with the study of a treatise emphasizing more strongly fundamental problems and their application to electrical design.

Methods of Measuring Electrical Resistance. By Edwin F. Northrup, Ph.D. New York: McGraw-Hill Book Company. 390 pages, illus. Price, $4.

A good treatise on the principles, methods and apparatus of measuring electrical resistances from the standpoint of electrical engineering. No other book with which we are acquainted covers just this field. The chapters relate to the following subjects: Electrical measurements, deflection methods, null methods, Wheatstone bridge methods, low resistances, conductivity, high resistances, insulation resistance, alternating-current measurements, resistances including electromotive force, fault location, temperature measurement, instruments, galvanometers. The plan of the book is eminently practical and adapted to the needs of the practitioner. Numerous practical examples are presented and worked out. The book will be useful to all who are interested in the principles and practice of electrical measurements.

A Manual of Physical Measurements. By Anthony Zeleny, Ph.D., and Henry A. Erikson, Ph.D. Third edition. New York: McGraw-Hill Book Company. 248 pages, illus. Price, $1.50.

An experimental laboratory textbook intended for college students in elementary physics. It is divided into six sections besides the introductory chapter, appendices and tables. The sections relate to the following subjects: Mechanics, fluids, heat, electricity and magnetism, sound, and light. The section on electricity and magnetism is much the longest. The work is divided under each section into experiments, for each of which the apparatus to be used is described and the procedure is outlined. The principal formulas are presented. The mathematics is all elementary. The descriptions are clear and the diagrams simple. A brief appendix outlines the simplest method of determining the probable error of observations. The book will be useful to teachers and students of elementary physics.

Design of Polyphase Generators and Motors. By Henry M. Hobart. New York: McGraw-Hill Book Company. 265 pages, illus. Price, $3.

Mr. Hobart has given us a very interesting book. In a lucid and comprehensive manner he enters upon his subject by discussing such simple though fundamental matters as the number of poles, the output coefficient and the ampere-conductors per pole, per phase and per centimeter of periphery, which he calls the "peripheral loading." The slot insulation and distribution of windings are then discussed, and the magnetic circuit is plainly and sensibly described. The armature reaction and the saturation and regulation curves are then explained, as well as the use of the short-circuit characteristic. Everywhere common-sense methods and common-sense modes of looking at the problem are used, and practical data, so largely at the disposal of an engineer of such vast experience as Mr. Hobart, are not omitted from the text. After the subject of alternating-current generators has been dealt with thus carefully, Mr. Hobart treats of induction motors in the same manner. It goes without saying that he utilizes the circle diagram extensively, giving also a useful bibliography of this important subject. In the discussion of slip-ring induction motors many interesting points will be found. The discussion of synchronous motors versus induction motors is also most instructive. A separate chapter deals with the induction generator, and examples for practice in designing conclude this useful treatise. The book will be found of assistance to both the student and the engineer, and for reference will be most helpful to those consulting engineers and station operators who wish to gain some authoritative information on the data which enter into the design of the machinery they are using.

New Apparatus and Appliances

An Illustrated Descriptive Record of Recently Developed Manufactured Products of Interest to Electrical Readers

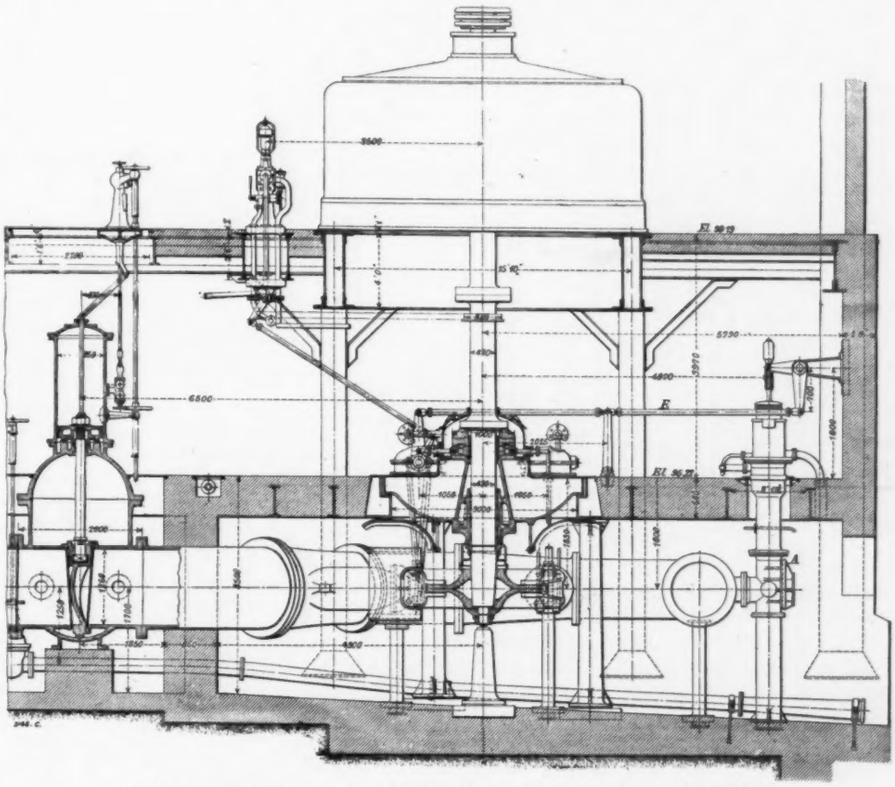
19,000-Hp Water Turbine for Rio de Janeiro

In the Pirahy power station of the Rio de Janeiro Tramway, Light & Power Company, which was described in the *Electrical World* May 13, 1909, there have recently been installed two 19,000-hp water turbines and generators.

The power station, which has been in operation since 1907, is situated on the River Lages about 50 miles from Rio. Three-phase energy is generated at 6000 volts and 50 cycles, the emf being stepped up to 80,000 volts for transmission. The equipment in operation prior to the installation of the two 19,000-hp units consisted of six 8700-hp impulse-wheel units and three 200-kw exciter sets, two of the latter being operated by Pelton wheels and one being motor-driven.

The River Lages has a drainage area of 193 sq. miles with an average rainfall of 59 in. a year. The river descends in a series of rapids and falls nearly 1000 ft. in a distance of only a few kilometers. A dam at the top of the falls forms a reservoir, with an average level of 1323 ft. above the sea. The power station is built 308 ft. above the sea level, so that the gross head available for the turbines is 1015 ft.

Water was conveyed from the dam to the power house by pipe lines in two sections, consisting of two upper low-pressure lines, one receiver pipe and six lower high-pressure lines. At the time the new units were installed two high-pressure pipe lines were added. The diameter of the low-pressure pipes is 8 ft. and that of the high-pressure pipes 3 ft. The lines are fitted with relief pipes. The high-pressure pipes for the new turbines are divided into three sections having diameters of 56 in., 54 in. and 52 in. respectively. Relief pipes 400 ft. long are installed. The gross head available at the turbines is 1015 ft., which is reduced by pipe friction losses to an equivalent of 925 ft.



19,000-HP WATER TURBINE WITH DIRECTLY CONNECTED GENERATOR

The arrangement of the new 19,000-hp units is shown in the illustration. The machinery room is constructed with two floors, the upper of which forms the station floor proper and carries the governors and control handles. The lower floor carries the thrust bearing of the vertical shaft of the machine and also the oil pumps which serve for lubrication and for the operation of the nozzle valves. The space below the thrust-bearing floor serves as the wheel pit, which has communication with the tailrace through the opening shown at the right-hand side of the cut. The station is built close to the bank of the river which takes the discharge, so that only a very short tailrace is necessitated.

The runner to which the buckets are secured is keyed to the bottom of the vertical shaft, the shaft having two main bearings, one directly above the turbine runner and the other on the base of the alternator frame. The shaft has also a thrust bearing just above the thrust-bearing floor. The turbine wheel is surrounded by a casing carrying four needle valves arranged symmetrically in a horizontal plane. The pipe distributing the water to the needle valves is arranged in the form of a spiral without sharp bends or angles, so that a smooth flow is obtained. The nozzles are entirely independent of each other and are governed directly by a motor operating with oil in such a way that the nozzle discharge corresponds with the load. The main water valve, which can be seen at the left-hand side of this illustration, is operated by means of pressure water taken from the incoming pipe line acting in the operating cylinder, which is fixed above the valve. The actual water connections to this cylinder are taken from the main valve by-passes.

Each pipe line is fitted with a pair of relief valves at its tailrace end, in order to limit the pressure rise under sudden changes of load. The valves, which are of sufficient capacity to allow the total quantity of water to pass if necessary, are operated in conjunction with the nozzle regulating gear. This gear is operated by two motors mounted on the base plate which carries the thrust bearing and one of the main bearings. The crossheads of the motors are connected up, by means of cranks, to short rocking shafts which are carried in domes on the base plate.

The rocking shafts operate the needle valves through double links.

As there are but two motors and four rocking shafts and needle valves, arrangements were made to interconnect the rocking shafts in pairs. This was done by means of bell-crank levers lying in a horizontal plane. One arm of each bell-crank lever is connected by short links to the head of the rocking-shaft crank which lies opposite the front end of the motor, while the other arm of the bell-crank lever is connected to an oscillating link. This link connects up to the crank of the rocking shaft which lies at the opposite side of the turbine from the motor which is driving it and at the back end of the second motor. The result of the arrangement is that the second rocking shaft lies at right angles to the first, which gives the best position for connecting up to the second needle valve, owing to the position of the incoming pressure pipe.

The interconnecting links *E* between the valve mechanism and the operating gear of the relief valves are shown in the illustration. The link is carried at the end of a crank secured to one of the rocking shafts, and thus operates the relief valves after the needle valves have closed to a predetermined amount. The relief valves are fitted with tandem cylinders, the lower of which are supplied with water from the main pressure pipe, and tend to open the valve. The upper cylinders are supplied with oil from the pump, and oppose the lower cylinders. The oil pumps are fitted in duplicate and each pump is driven by a Pelton wheel. The pumps work in conjunction with a common oil accumulator. Each pump is large enough to supply the whole of the oil required for the operation of its turbine, so that the other is available as a stand-by. The oil supply to the governor and motor is at a pressure of 350 lb. per square inch, but the pressure is reduced to 120 lb. per square inch for the bearings.

The turbines and governors were built by the Escher, Wyss Company, Zurich, Switzerland, and the installations of the machinery as well as the pipe lines were made by the same concern.

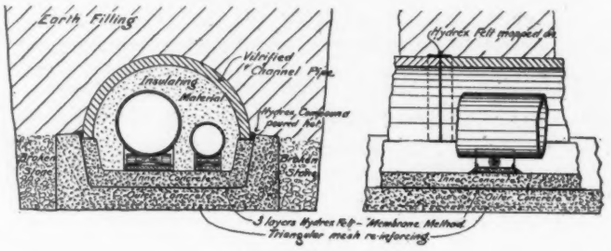
The generators were furnished by and are of the standard design of the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Steam-Pipe Conduits

Central stations engaged in steam-heating practice are constantly brought face to face with the problems of economical and flexible distribution by underground piping systems. To meet the demands of watertight construction, durability and efficiency in this class of work, and also to provide a reliable method of transmitting steam underground in high-pressure service, a new type of conduit illustrated in the accompanying diagram has been developed with patent pending under the control of Mr. Percy N. Kenway, 79 Milk Street, Boston, Mass. The illustrations show typical transverse and longitudinal sections through the so-called "W.E.D." conduit.

The lower portion of the conduit is composed of three separate elements—an outer trough-shaped monolithic shell of concrete reinforced with triangular metal mesh, a waterproofing course of three layers of "Hydrex" felt mopped on with hot "Hydrex" compound, according to the so-called "membrane method," and an inner monolithic shell of concrete. The upper portion consists of vitrified channel pipe with water-tight "Hydrex" joints sufficiently elastic to permit slight movements due to expansion or contraction. At each side of the channel pipe, and between it and the outer concrete shell, a longitudinal groove is formed as shown in the cut. This groove is filled with "Hydrex" compound, poured hot, making an elastic and water-tight joint. As there are no joints in the lower portion of the conduit and as the outer shell is reinforced, the danger of uneven settlement and leaky joints is eliminated. With the double shell and the waterproofing course, expansion cracks in either the outer or the inner shell are of no real importance.

The pipe supports rest on a flat surface and may consist simply of plates and rolls, the concrete lower portion forming a solid base upon which to install the pipes. Another



STEAM-PIPE CONDUITS

advantage claimed is that the longitudinal joint does not depend for its tightness upon the matching and careful cementing of the upper and lower sections of a split tile pipe. All joints below the center are eliminated, and if leaks develop in the steam pipes or if alterations are required at any time, this conduit can be broken into and repaired at a minimum expense.

Water Sterilizing by Means of Ozone

By J. P. Schroeter

It is claimed that the sterilizer invented by Mr. Siegfried Held sterilizes water perfectly and instantaneously. The device consists of an ozonizer which can be attached to any faucet in a house where electricity is available. In case alternating current is present a transformer steps up the voltage, and in case of direct current a small rotary converter or vibrator according to the size of the outfit changes the supply into alternating current. In larger installations a fan with attached motor is provided for driving air through the ozonizer.

The latter consists of a tubular electrode placed in a vacuum tube and of another tubular electrode surrounding the vacuum tube. By means of inturned lips a space for the passage of air between the outer electrode and the tube is provided. The discharges take place between the electrodes with an output of fifty-eight parts of ozone in 10,000 parts of air. This ozonized air is conducted to an especially constructed faucet, where it is mixed with the water. The effluent leaves the faucet completely sterilized. Filters are introduced for the purpose of eliminating coarser suspended particles.

The absence of any nitrites is worth mentioning. The discharged water carries with it some of the peculiar odor of ozone, which, however, vanishes in the time required to bring the glass to the mouth, so that the result is a clear, odorless water. A push-button on the faucet brings the apparatus into action, the water pouring out instantly, as from any other faucet.

RESULTS SHOWN WITH USE OF OZONIZER

Unfiltered Lake Water Inoculated with	Number of Bacteria per Cubic Centimeter Before Ozonization	Number of Bacteria After Ozonization
Colon bacilli	2100	0
Typhoid bacilli	6800	1
Typhoid bacilli (second test)	5600	0
Dysentery bacilli	4100	0

Tests made in leading laboratories have shown perfect sterilization. The Laboratory of Hygiene, Pathology and Bacteriology, Chicago, made tests with somewhat turbid, unfiltered lake water (turbidity 30) and with clear sparkling distilled water. A definite portion was artificially contaminated with a large number of colon, typhoid and dysentery bacilli, all three of which types are intestinal and often present in water supplies. After a definite quantity of the bacterial emulsion was added to the water, the ozone was generated and samples were collected for examination of the untreated and the ozonized water. The result is given in the accompanying table.

The single typhoid bacillus remaining after the ozonization in the first test probably dropped into the sterile bottles from the mouth of the nozzle without having undergone treatment.

The tests with distilled water inoculated with pathogenic bacteria showed the same results; that is, perfect sterilization.

Mr. H. McCormack, of the Armour Institute, found that water with from 150 to 270 bacteria per cubic centimeter present was rendered perfectly sterile. Further tests with pathogenic bacteria, such as colon and typhoid, which were in some instances present to the extent of more than 1,000,000, produced the same results of perfect sterilization.

Mr. C. H. Higgins, of the Gulick-Henderson Company, chemists, assayers and metallurgists, Chicago, made tests for nitrites and found negative results. A series of tests were made to ascertain if any nitrites were formed when ozone was generated for purifying water for drinking and domestic purposes. The tests were made on Lake Michigan water, both filtered and unfiltered, but tests showed that no nitrites were formed by the machine, although several operating tests were made varying in length of time from an instant up to fifteen minutes, which, particularly in cases of long operation, necessitated the generation of a large amount of ozone.

From these results, together with the fact that a sample of highly ozonized water was kept tightly sealed for two days and that still no nitrites were found, it seems positive that no nitrites are formed by the ozonizer.

Fig. 1 shows a photograph of an ozonizer attached to a kitchen faucet. Fig. 2 is an ozone water sterilizer plant for an apartment building. The ozonized air and water mix in the sterilizer tank, whence the sterilized water is conducted into the storage tank from which it is forced into the house service.

These sterilizers are made by the Held Company, Chicago.

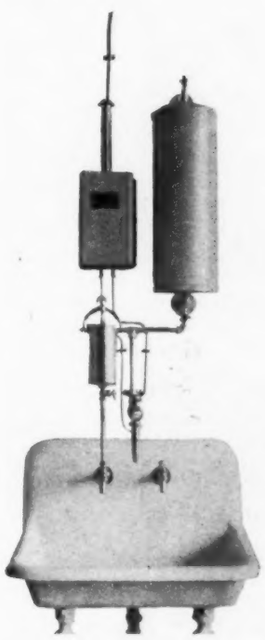


FIG. 1—OZONIZER ATTACHED TO KITCHEN FAUCET

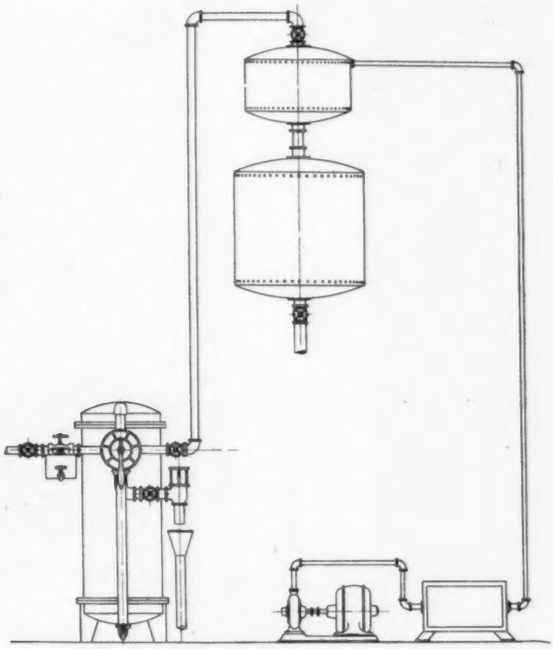


FIG. 2—WATER STERILIZER PLANT FOR APARTMENT HOUSE

Electric Combination Fireless Cooker

The Caloric Company, Janesville, Wis., manufacturer of fireless cookers, and the Hughes Electric Heating Company, Chicago, have united their efforts in producing an electric combination fireless cooker which eliminates the preliminary heating of the food to be cooked by the use of a separate device.

Several sizes of the "fireless" electric cookstove are manufactured having one, two and three compartments, each having a capacity of 8 or 12 quarts as desired. The cooking compartment is lined with seamless aluminum and the radiation of heat is prevented by filling the space between the aluminum box and the casing with kieselguhr, a natural non-heat-conducting mineral which is mined in the western part of the United States. A 500-watt electric-heating unit is secured to the bottom of each compartment in such a manner that it can be readily removed in case repairs are necessary.

COMBINATION ELECTRIC FIRELESS COOKER

Connections can be made with an electrical outlet by means of a cord and plug. When electricity is not available the soapstone radiators which are furnished with the cookstove can be heated over a flame and placed in the compartment to furnish the preliminary heat which is necessary in a fireless cooker.

The cookstove shown in the illustration is 17 in. square, has one cooking compartment, and is set on a cabinet in which cooking utensils, baking racks and other equipment used in conjunction with the cooker may conveniently be stored.

A meal for five people, consisting of roast beef and three kinds of vegetables, including potatoes, was prepared in one of these cookstoves at a recent demonstration. The electricity was turned on for twenty minutes, after which the food was allowed to cook for two hours. The energy consumed is reported to have been 0.167 kw-hr.

Illumination at the Baltimore Automobile Show

The artificial illumination used in connection with the Baltimore Automobile Show recently held in the Fifth Regiment Armory Building was one of the attractive features of this exhibit. The floor area of this spacious armory is approximately 325 ft. by 225 ft. and afforded favorable

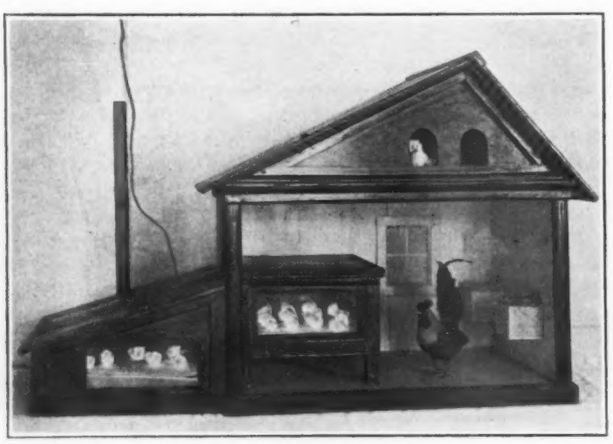
ILLUMINATION OF AUTO SHOW ROOM

opportunities for the production of spectacular and decorative lighting effects.

The fixtures were suspended uniformly from the ceiling. The installation consisted of 1100 100-watt, 1300 25-watt, 250 40-watt and 100 60-watt Sterling tungsten lamps. An idea of the splendid illumination provided by these units can be gained by referring to the accompanying illustration.

Electric-Incubator Display

At the recent St. Paul convention of the Minnesota Electrical Association an exhibit made by the Northwestern Electric Equipment Company, of St. Paul, attracted considerable attention. It consisted of an electric in-



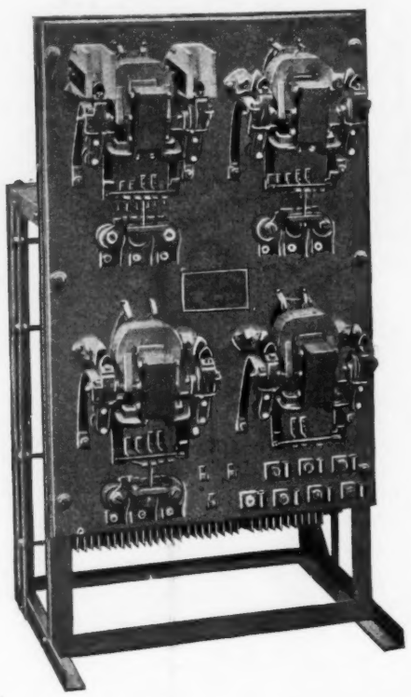
ELECTRICAL INCUBATOR EXHIBIT

cubator and brooder specially arranged as a show-window attraction and included a number of imitation baby chicks made of translucent glass and electrically lighted from within. A large stuffed rooster was also prominent in the display. Electricity was used for both lighting and heating this attractive exhibit, which originated with Mr. F. G. Klein, Jr., of the company named. The exhibit has attracted so much attention from various electrical dealers that the company has made it a part of its traveling dealers' exhibit, and it is now sending the exhibit out to dealers for general advertising purposes.

Self-Starter for Polyphase Motor

A new line of self-starters for polyphase slip-ring motors has been placed on the market by The Cutler-Hammer Manufacturing Company, Milwaukee, Wis. One is designed for use with motors driving reciprocating pumps, air compressors and similar machines that must be started under full load requiring a starting torque equal to or in excess of the normal full-load torque of the motor. The other class is designed for use with motors driving centrifugal pumps or other machines having similar load characteristics.

These new types of self-starters are of the multiple-



SELF-STARTER FOR POLYPHASE SLIP-RING INDUCTION MOTOR

solenoid type and are entirely self-contained. Where used in connection with motors operating on the compression or open-tank system, the motors can be started and stopped automatically by means of pressure regulators or float-type switches.

The acceleration of the motor is controlled by resistors in each of the three phases of the rotor circuit, which is cut out of the circuit step by step by two-pole solenoid switches under the control of the secondary current relays. The resistance is balanced on all steps. The rate of acceleration is controlled by three-phase current relays in the rotor circuit, each arranged so as to prevent the following step of resistance from being cut out of circuit until the secondary current has dropped to a safe value and the motor has accelerated properly, when it will permit the next step of resistance to be cut out. The starting current is limited to a predetermined and adjustable value by the current relays and the motor is accelerated in the shortest time consistent with this starting current. The current relays have three coils connected in the secondary circuit with the starting resistance and carrying the starting current. The relay plungers are thus controlled directly by the starting

current, and the rate at which the motor is accelerated can be adjusted by varying the spring tension on the relay plungers.

Electrical Laboratory for High School

On page 846 of the issue of April 19 a description was given of the electrical laboratory of the West Philadelphia High School, Philadelphia. The equipment in this laboratory is so arranged that by bridging from right to left to a central board by means of cable and attachment plugs either direct current or alternating current can be obtained at any location in the laboratory. The electrical equipment of this installation was furnished by the Diehl Manufacturing Company, Elizabeth, N. J.

Portable Wheatstone Bridge

A portable testing set, weighing 8 lb. and measuring when closed only 7⅝ in. by 8¾ in. by 4½ in., is being placed upon the market by the Leeds & Northrup Company, Philadelphia. The set, which is shown in the illustration, is adapted for resistance measurements within the range of the Wheatstone bridge. By means of two small double-throw switches the internal connections are changed for the Murray or Varley loop tests used in locating grounds, crosses, etc., on lines and cables. The set may also be used for locating broken wires. The ratio and rheostat resistors are controlled by dial switches, the contacts being entirely inclosed and thus protected against dust and dirt. The contacts are readily accessible, however, for inspection.

The ratio resistors are controlled by a single dial switch, thus eliminating the possibility of confusion due to uncertainty as to whether the ratio value to be used is to be taken as the "A" arm value divided by the "B" arm value or the reverse.

PORTABLE WHEATSTONE BRIDGE

All resistors are wound upon metal spools, which makes them more stable in their adjustment than those wound upon wooden spools. Moreover metal-spool resistors will carry more current than wooden-spool resistors and therefore the coils in this set are less liable to be burned out because of excessive currents than are those in sets using wooden spools. The rheostat coils are claimed to be accurate to 0.1 per cent and the ratio coils to 0.05 per cent. The galvanometer is of a new type having a specified sensitivity of 1 megohm. The moving system is contained in a separate unit which may be readily removed if it should become damaged. A battery of four cells is contained in the instrument. Provision is made for using both an external battery and a galvanometer, should this be desirable. All necessary switches and binding posts are provided.

Electric Automobile-Steering Signals

The device illustrated is designed to eliminate automobile accidents at street crossings by warning foot passengers which way the car is about to turn. It also prevents rear-end collisions by flashing similar signals from the rear of the car. Each of the four electric signs is lettered in black on white glass with the words "left" and "right." Ordinarily the signs are concealed by metal covers, but a pressure of a switch on the steering wheel throws up the cover and at the same time lights a small incandescent lamp behind the sign. A storage battery supplies the energy. The parts of the sign are quite inconspicuous except when in use. The device is made by the Quartette Automobile Signal Company, San Fernando Building, Los Angeles, Cal.

ELECTRIC SIGN INDICATING DRIVER'S INTENTION

Rough Usage of Storage Battery

Some interesting tests were recently made by Mr. F. W. Jackman, at the Acme Electric Auto Works, Los Angeles, Cal., on the so-called Revivo dry-storage battery, manufactured by the Cook Railway Signal Company, Denver, Col., and described in our issue of Jan. 4, 1913.

A 2-volt, 20-amp-hr. and a 6-volt, 20-amp-hr. battery received a number of charges and discharges, and each time these batteries showed a discharge considerably over their normal rating. Afterward they were discharged at ten times their normal rate, the load being left on them for twenty-four hours after they were completely discharged. Then they were charged at four times their normal charging rate, discharged again at a rapid rate and left in this condition for thirty days. At the end of thirty days they were charged at their normal charging rate. They recuperated well and were again discharged at more than their normal rate.

Industrial and Financial News

Public Utility, Commercial, Corporate and Trade Developments—The Electrical Material and Security Markets

Start Construction of Canada's Largest Power Station.—Fraser, Brace & Company, 1328 Broadway, New York, to whom, as noted last week, the contract has been awarded for erecting the power station of the Cedar Rapids Manufacturing & Power Company, Montreal, Que., have started work on this hydroelectric station, which, when completed, will be the largest in the Dominion of Canada. Its initial rating will be about 100,000 hp, and later on this will be increased to 160,000 hp. The site is at Cedar Rapids, in the St. Lawrence River, about 30 miles above Montreal. The plant will be 663 ft. long and 130 ft. wide and will be built as a part of the dam. The intakes will be of the scroll or involute type. Orders have been placed by the Cedar Rapids company for the generating equipment. This includes twelve 10,800-hp waterwheels, which are to operate at 56 r.p.m. under a head of 30 ft, and will be the largest ever built. There will also be three 1500-hp exciter units which will operate under the same head at 150 r.p.m. The Canadian General Electric Company will furnish the twelve generators to be connected to the waterwheels. The contract for the latter was divided between the I. P. Morris Company, Philadelphia, and the Wellman-Seaver-Morgan Company, Cleveland. The contract awarded to the first-named company includes the design, construction and installation of nine of the main units, the three exciter units and the governors and pump auxiliaries for all the units. The Wellman-Seaver-Morgan Company is to construct three of the main units from the same design as the others. The design of the turbines will be very much the same as that of the wheels for the plant of the Mississippi River Power Company, at Keokuk, Ia. The chief difference will be in arranging for carrying the weight of the generator rotor and the moving parts of the turbine on a thrust bearing above the generator instead of below, as is done with the Keokuk turbines. The waterwheel contract includes the turbine complete, the shaft running through the turbine and generator, the thrust-bearing support or truss to be located above the generator, also the thrust bearing complete. The weight of the generator will be taken through cast-iron supporting barrels through the turbine to the foundation below. The main units will be of the single-runner vertical-shaft type and will be installed in wheel chambers of spiral shape formed in the concrete foundations of the power house. The exciters will be of the same type but smaller in size. The runners for these wheels will be an enlargement of a model runner which under test at Holyoke gave an efficiency of 90 per cent. About 100,000 yd. of concrete work and 2,000,000 yd. of rock and earth excavating is to be done by Fraser, Brace & Company. Contracts for 80,000 hp of the output of this station have already been closed. Of this, the Aluminum Company of America will take 60,000 hp and the Montreal Light, Heat & Power Company will take 20,000 hp. It is expected that the plant will be finished in October, 1914.

National Conduit & Cable on the Copper Situation.—The National Conduit & Cable Company, 41 Park Row, New York, makes the following comment upon the copper market: "Conditions have improved sufficiently in the copper situation apparently to warrant higher prices, and the market has had a good recovery from the recent low range touched more than a month ago. Sales during the last few weeks were heavier than for a long time previous, and both domestic and foreign manufacturers bought on a liberal scale. Market activity developed the last part of March and transactions of importance were closed at 15 cents. Substantial sales were made later at advancing prices, and with Europe an active buyer further market advances were recorded without meeting serious resistance. It transpired that a good deal of copper was needed for prompt shipment, and as domestic and foreign demand increased, prices soon reached the 15½-cent level. With the decided improvement in the local statistical position of copper there is nothing apparently in the present situation to suggest any material falling off in prices. On the contrary, if manufacturers continue as busy as they have been lately and the rate of copper production is not increased over that for the month of March, it is expected that the market will be able to maintain a healthy degree of firmness for some time to come."

Changes in United States Light & Heating Company.—At a special meeting of the directors of the United States Light & Heating Company, Niagara Falls, N. Y., J. Allen Smith, formerly general manager, was elected president, to succeed D. W. Pye, who resigned some time ago. Charles A. Starbuck, president of the New York Air Brake Company, was elected chairman of the board. F. P. Frazier was elected a vice-president, to succeed Mr. Starbuck, and W. P. Hawley was also made a vice-president. A. H. Ackerman was made general manager, succeeding Mr. Smith. W. S. Crandell was re-elected secretary and treasurer. Business with the company is very good, according to one of its representatives, who said: "Our total sales for last month amounted to $446,945, as compared with $370,352 in February. We are now employing about 1600 hands at our plant at Niagara Falls and have contracted to supply the Edwards-Knight, Rambler, Moyer, Willys-Overland and several other well-known types of automobile with our electric starters. Business at present is good and the outlook for the spring and summer months is very bright."

Large Turbine Unit for German Lighting Plant.—Brown, Boveri & Company, of Baden, Switzerland, are building a 40,000-hp steam turbine for the electric power station at Hagen, Westphalia, Germany. This will be the largest turbine unit ever manufactured in Europe. The largest units now in operation are two 30,000-hp steam turbines built by the same company. These are installed in the works of the Rhine-Westphalia Electric Power Company, Düsseldorf, and have been in service since the middle of 1912. Each is connected to a 21,500-kva generator.

Norfolk & Western Electrification Plans.—The Norfolk & Western Railway Company, Roanoke, Va., is arranging to electrify its line from Eckman to Bluefield, Va., a distance of 27 miles. The preliminary work is now under way, but as the plans are not very far advanced, no details are yet available. Negotiations are in progress with the Appalachian Power Company, Bluefield, Va., relative to a supply of electrical energy, but it has not been decided yet whether the railway company will purchase the necessary energy.

New President for Manhattan Electrical Supply Company.—On April 19 the directors of the Manhattan Electrical Supply Company, 17 Park Place, New York, held a special meeting to fill the vacancy in the office of president of the company caused by the recent death of H. T. Johnson. At this meeting J. J. Gorman was elected president, B. H. Ellis, treasurer of the company, was also elected vice-president. Messrs. Whitemore, Pierce and Manger will continue in the offices held by them.

Contracts for Street Lighting Line Material.—The Line Material Company, South Milwaukee, Wis., maker of the Kyle line material, has secured contracts from the Sanitary District of Chicago for supplying two-pin, four-pin and six-pin malleable-iron cross-arms and also for supplying malleable-iron lamp brackets of the type used in connection with overhead-construction street lighting. These two contracts involve an expenditure of approximately $30,000.

Illinois Traction Company's Year.—The ninth annual report of the directors of the Illinois Traction Company, Champaign, Ill., covering operations for the year ended Dec. 31, 1912, shows that the gross earnings of the company in that year were $7,415,647, as compared with $6,902,221 in the preceding year. Of the total gross earnings in 1912, the receipts from operation of interurban lines amounted to $2,964,955 and those from city lines equaled $2,030,993; gas returns were $428,976, steam-heating income was $219,170, and the income from sale of electrical energy was $1,689,477. This last figure compares with $1,473,937 in the year ended Dec. 31, 1911. Miscellaneous receipts amounted to $82,076. The total operating expenses and taxes of the company in 1912 were $4,353,213, leaving net earnings from operation of $3,062,433, as against $4,133,640 in 1911. After payment of bond interest and preferred dividends there was a surplus for the year of $741,917, which compares with $565,082 for the preceding year. Several small properties were added to the company's holdings during the year. These acquisitions were: The Carlinsville (Ill.) Utilities Company; the Georgetown (Ill.) Electric Company; the electric plants at El Paso, Gridley and Chenoa, to be served by a transmission line from Bloomington, and the Morton Light, Heat & Power Company, Fremont, Ill. The Illinois Traction Company is furnishing forty-eight cities and villages in Illinois, Kansas and Iowa with electrical energy.

Will Complete Michigan-Lake Superior Power Company's Plant.—As was stated in these columns last week, the reorganization committee of the Michigan Lake Superior Power Co., Sault Ste. Marie, Mich., has adopted a new plan for the financial rehabilitation of that company. That a plan has been adopted was due largely to the co-operation of the Union Carbide Company, 79 William Street, New York, which has works at Sault Ste. Marie and also at Niagara Falls. L. H. Davis, manager and chief engineer of the Michigan Lake Superior Power Company, said concerning the reorganization: "The efforts of the first-mortgage bondholders to reorganize the company upon a firm and substantial basis have finally been successful, made so through the co-operation of the Union Carbide Company, which is anxious that the canal be put in maximum operation in order that the power company can deliver to it sufficient energy to operate its plant at the 'Soo' at full capacity." E. F. Price, vice-president of the Union Carbide Company, stated that the interest of his company in the matter lay in the fact that by full operation of the plant at the "Soo" his company would be able to utilize all of its manufacturing facilities, only part of which have been in use since the failure of the power company to deliver all the energy required. Negotiations are now pending with the government for a lease of water, and as soon as this is given, work on construction of the power plant will be started again.

Electrical Plans of Lehigh Coal & Navigation Company.—Plans are being made by the Lehigh Coal & Navigation Company, Philadelphia, to purchase the controlling interest in the Harwood Electric Company. The latter, whose head office is at Philadelphia, supplies electrical energy to twenty-seven townships in Luzerne, Schuylkill, Northumberland, Columbia, Montour and Carlson Counties, Pa., including the towns of Hazleton, Mahanoy City, Bloomsburg, McAdoo, Berwick, Shenandoah, Danville and Mount Carmel. With its subsidiaries, the Harwood Electric Company has a total outstanding capitalization of $6,831,500, of which $3,000,000 is in common stock. It also has extensive coal holdings. Acquisition of the Harwood company will give to the Lehigh Coal & Navigation Company control of the electric-service business in the Lehigh and Schuylkill regions and the Susquehanna Valley. The Lehigh Coal & Navigation Company will place the initial equipment of its power station at Hauto, Pa., in operation early in June of this year.

Highland Power Company to Operate in Colorado.—The Highland Power Company has been formed by Philadelphia, New York and Colorado interests to erect a power-station on Middle Boulder Creek, near Hesse, Boulder County, Col. The new concern will enter into competition with the Colorado Power Company for the privilege of lighting Central City and Black Hawk, Col., and for furnishing energy to the tungsten and placer mines of Boulder County. The company has $500,000 of 6 per cent cumulative preferred and $600,000 common stock. Contracts have been let for the installation of a 3000-hp generating station and for the erection of transmission lines through Boulder and Gilpin Counties. Half of the output has been contracted for at 1 cent per kw-hr. The president of the company is J. H. Bair, Philadelphia.

To Manufacture Electric Starting, Lighting and Ignition Devices.—The Bailey Electric Company, with offices and plant at 503 Grandville Avenue, Grand Rapids, Mich., was formed recently to manufacture electric starting, lighting and ignition equipments for automobiles. All of the company's manufacturing arrangements have been completed and production is already under way. The officers of the company are: President, H. B. Woodcock; vice-president, A. R. Cosgrove; secretary, H. D. Wilson, and treasurer, R. G. Woodcock. B. F. Bailey is consulting engineer for the company. The company's line of equipment includes both the combined system of starter, generator and ignition apparatus in one unit and the separate unit systems in which the starter, generator and ignition devices are installed as separate units.

California Companies to Merge.—The Cloverdale (Cal.) Light & Power Company and the California Telephone & Light Company of Santa Rosa have asked the California Railroad Commission to authorize the first-named company to sell its property to the second. The California Telephone & Light Company has also asked for authority to issue immediately and sell 6 per cent bonds to the amount of $350,000. The proceeds are to be used to discharge existing obligations to the amount of $228,000, to purchase the property of the Cloverdale company for $75,000 and to make improvements to cost $17,000.

Growth of Western Electric's Business.—In a recent review of the commercial activities of the Western Electric Company since 1884 it was shown that the business of the company has broadened considerably, year by year, with but one exception. In 1906 the business grew from approximately $44,000,000 to $69,000,000. During 1907 and 1908, when the financial situation was in an acute state, the business fell off to some $33,000,000, but after 1908 it grew again at a rapid rate until for the year 1912 the sales amounted to $72,000,000—the largest total in the history of the company.

Will Ask Charters for Twenty Lighting Companies in Pennsylvania.—On May 5 interests controlling the Bucks County Electric Railway Company, of Newton, Pa., and the New Jersey & Pennsylvania Traction Company, of Trenton, N. J., will apply to the Secretary of State of Pennsylvania for charters for twenty electric lighting companies which will operate in the sections of Bucks County traversed by the Philadelphia & Eastern Railway. Practically all of the important townships in Bucks County are within the territory covered by the charters.

Barstow Company Enlarges Holdings.—The General Gas & Electric Company, which controls and operates a number of public-utility properties in the Middle West and East, and is under the direction of W. S. Barstow & Company, 50 Pine Street, New York, has purchased through the latter all the common and preferred stock of the Sandusky (Ohio) Gas & Electric Company. This company has a capitalization of $500,000 common and $100,000 preferred stock and $500,000 5 per cent bonds outstanding.

Alabama Interstate Power Buys More Equipment.—The Alabama Interstate Power Company, Birmingham, Ala., has let contracts aggregating $200,000 for electrical supplies, gates for locks, etc., for its hydroelectric development, now under construction on the Coosa River, near Birmingham. This is the final series of contracts for station material. The order was divided between the General Electric, Westinghouse and Pennsylvania Steel companies.

Defeat Bond Issue for Los Angeles Municipal Distribution System.—At an election held in Los Angeles on April 15 the citizens defeated a propostion to issue $6,500,000 in bonds to cover the cost of installing a municipal system to distribute the electrical energy generated at the plants on the aqueduct.

Progress of Toledo (Ohio) Railways & Light Controversy.—In a note in these columns on April 12 it was stated that at a meeting of the directors of the Toledo Railways & Light Company on April 3 Morris Allen was elected president and L. E. Beilstein was made general manager of the company and that these men replaced F. R. Coates, who had held both offices. It was also stated that Mr. Allen is a son-in-law of Barton Smith, counsel for the company and for the stockholders' reorganization committee. Following these changes the Doherty interests applied for an injunction restraining the Barton Smith interests from operating the property. On April 17 Federal Judge Killets, sitting at Toledo, granted to the representatives of Henry L. Doherty & Company a temporary injunction ousting the Barton Smith faction from the management of the company. This gave possession of the property to the Doherty interests, who, it is understood, control 83 per cent of the outstanding stock. The bill of complaint filed by the Doherty interests alleges that Barton Smith conspired with others to keep the majority stockholders and lawful owners out of control of the property after they had refused to pay his bill for $49,000 for professional services as attorney for the stockholders' protective committee. Upon the issuance of Judge Killets' order, F. R. Coates was at once installed as president, M. R. Bump, of New York, as auditor, and F. J. Derge as operating manager. A ruling on motions to make the injunction permanent has not been given. The hearing on the permanent injunction case was begun before Judge Killets on April 18. The defendants on the same day denied that they are attempting to aid Barton Smith to collect any sum of money and claimed that the United States court did not have jurisdiction in the case. They also denied that the plaintiff is the owner of 117,447 shares of stock of the Toledo Railways & Light Company or any shares whatever in the company, and that there was any arrangement made through which Maurice Allen was elected president and L. E. Beilstein general manager.

Pennsylvania Properties Consolidated.—The Edison Light & Power Company, of York, Pa., has been organized by interests affiliated with the York Railways Company for the purpose of consolidating various lighting subsidiaries of the latter and to acquire other electric-service properties. The properties merged into the new company are the Edison Electric Light Company, the West York Electric Light Company, the Mount Wolf Electric Light Company, the Dover Electric Light Company, the Hallman Electric Light Company and several other electric-service and steam-heating concerns operating near York. In nearly every case the foregoing companies were organized originally for the purpose of distributing energy generated by the Edison Electric Light Company in communities near York, since, under the laws of the State of Pennsylvania, it is necessary to organize a separate company for each township in which a lighting franchise is obtained. All the franchises having been acquired, the several companies have been brought under one holding corporation for the purpose of facilitating economical operation.

New Subsidiary for Utah Power & Light Company.—The Western Colorado Power Company, which was formed recently, is to be a subsidiary of the Utah Power & Light Company, Salt Lake City, and will hold and operate the Colorado properties of that company. Besides taking over the Colorado properties, the Western Colorado Power Company has also taken over the Durango (Col.) Gas & Electric Company and the San Juan Water & Power Company of Durango. J. T. Clay, manager of the Colorado properties of the Utah Power & Light Company, is to be general manager of the Western Colorado Power Company. The headquarters of the latter company will be in Durango.

Increasing Sales of Electrical Equipment to Automobile Trade.—One feature of the business of the General Electric Company at this time is the large increase in the sale of electrical equipment to the automobile trade. One automobile accessory manufacturer, who has been in business only two years, is now buying electrical apparatus at the rate of $3,000,000 a year from the General Electric Company. As was stated last week, the latter is doing a record business and is taking orders 40 per cent in excess of its productive capacity.

Great Western Power's Showing.—The Great Western Power Company, San Francisco, has issued its annual report for the year ended Dec. 31, 1912. On that date, according to the report, the company had 11,382 consumers of electrical energy on its books, a gain of 7152 for the year. The connected load was 102,935 kw, which represents an increase of 20,835 kw during the year. In addition to this connected load, the company also made contracts from which an estimated revenue of $155,000 will be obtained.

Pacific Electric to Make Improvements.—The California Railroad Commission has authorized the Pacific Electric Railway Company to issue $6,839,000 5 per cent first-mortgage bonds. The proceeds of these will be used in extensions and additions to the properties of the company. Of the proceeds $3,428,000 will be used for extensions and branches, $1,554,000 for rolling stock, and the balance for various improvements, including additions to power stations.

Pacific Telephone & Telegraph Company Plans Improvements.—Officials of the Pacific Telephone & Telegraph Company, San Francisco, which has over 5,000,000 subscribers in California, Oregon and Washington, are contemplating an expenditure of $111,600 for improvements and extensions to the company's system.

Electrical Energy for Utah Copper Company.—The plants of the Utah Copper Company are to be operated by electricity from the mains of the Utah Power & Light Company, Salt Lake City, about Jan. 1, 1914.

Detroit Independent Telephone Company Absorbed.—The Bell Telephone Company has taken over the Home Telephone Company of Detroit, Mich.

Allis-Chalmers Stock Assessments.—The fourth assessment on the stock of the Allis-Chalmers Company was payable on April 24.

Industrial Securities

Security	Capital Stock Listed	DIVIDEND		QUOTATION	
		Per Cent	Period	April 16	April 23
Allis-Chalmers, t.r., 3d pd...	$17,196,600	.....	.....	3	3
Allis-Chal., pf., t.r., 3d pd...	14,165,500	.....	.....	6⅜	7½
Amalgamated Copper.....	153,887,900	1½	Q	76¾	77
American Tel. & Tel.....	344,465,900	2	Q	131⅛	129⅜
Electric Storage Battery, c.	16,074,425	1	Q	50	49⅜
General Electric.....	101,301,200	2	Q	139⅞	140¼
Mackay Cos., c.....	41,380,400	1½	Q	83*	83*
Mackay Cos., pf.....	50,000,000	1	Q	69*	67½
Western Union Tel.....	99,747,200	¾	Q	66¼	66¼*
Westinghouse, E. & M., c...	34,076,350	1	Q	63¾	64¼
Westinghouse, E. & M., pf..	3,998,700	1¾	Q	116¼*	118½*

*Last price quoted.

NEW YORK METAL MARKET PRICES

	April 15 Bid.	April 15 Asked.	April 22 Bid.	April 22 Asked.
Copper:				
Standard, spot	15.12½	to 15.50	.....	to 15.50
	£ s d		£ s d	
London, standard, spot	69 1 3		67 18 9	
Prime Lake	15.60	to 15.70	15.65	to 15.70
Electrolytic	15.55	to 15.65	15.55	to 15.65
Casting	15.40	to 15.50	15.40	to 15.50
Copper wire, base	16.50		16.75	
Lead	4.35		4.50	
Nickel	40.00	to 45.00	40.00	to 45.00
Sheet zinc, f.o.b. smelter	8.00		7.75	
Spelter, spot	5.75	to 5.87½	5.60	
Tin, spot	49.40		49.40	
Aluminum:				
Prompt delivery	26.75	to 27.00	26.50	to 27.00
Future	26.75	to 27.00	26.50	to 27.00

OLD METALS

Heavy copper and wire	14.75	14.50
Brass, heavy	9.37½	9.37½
Brass, light	8.25	8.25
Lead, heavy	4.25	4.25
Zinc, scrap	4.87½	4.87½

COPPER EXPORTS IN APRIL

Total tons to April 23 22,936

Personal

Mr. G. Devlin has been appointed sales manager of the Toronto (Ont.) Hydro-Electric System, vice Mr. Harry Jacobs.

Mr. E. C. Johns, formerly of Jersey City, has become associated with the Huron Light & Power Company, Huron, S. D.

Mr. D. R. Blaicher has resigned as purchasing agent of the Toronto (Ont.) Electric Light Company, Ltd., and has moved to Minneapolis, Minn.

Mr. H. F. See, formerly at the Lumberton (N. C.) office of the Yadkin River Power Company, is now at Wadesboro, with the same company.

Mr. H. H. Beasley, purchasing agent for the Toronto Railway Company, has also been appointed purchasing agent for the Toronto (Ont.) Electric Light Company.

Mr. George Schwanger has been promoted to the position of enginer of distribution with the Toronto (Ont.) Hydro-Electric System, succeeding Mr. A. Lang, resigned.

Prof. Robert Andrews Millikan, of the department of physics of the University of Chicago, has had awarded to him by the National Academy of Sciences the Comstock prize for research in electricity.

Mr. S. B. Hammond, who has been with the Porto Rico Railways in San Juan, Porto Rico, for the past two years, has returned to Montreal, Que., as secretary of the Montreal Engineering Company, Ltd.

Mr. Percy E. Hart, formerly connected with the Canadian General Electric Company, has been appointed electrical engineer of the Toronto (Ont.) Hydro-Electric System, succeeding Mr. J. D. Jackson, resigned.

Mr. H. A. Horner, electrical engineer for the New York Shipbuilding Company, delivered a lecture recently before the Franklin Institute of Philadelphia, describing the electrical equipment of the modern battleship.

Mr. Thomas Newell, Jr., has succeeded Mr. Arthur Perman as superintendent of the municipal electric-lighting plant at Adrian, Minn., Mr. Perman having taken charge of the municipal plant at Appleton, Minn.

Mr. J. L. Mishler has severed his connection with the Kelly Foundry & Machine Company, of Goshen, Ind., and has become associated as secretary with the Goshen Novelty & Brush Company, manufacturer of wood and metal lighting fixtures.

Mr. H. Reyss, chief engineer of the export department of the Siemens-Schuckertwerke, Berlin, Germany, is at present visiting this country for business purposes. Mr. Reyss was previously connected with the Japanese house of the same concern at Tokio. He will return to Germany on May 13.

Mr. H. H. Couzens, formerly general manager and electrical engineer of the Corporation of Hampstead, London, England, has been appointed general manager of the Toronto (Ont.) Hydro-Electric System, succeeding Mr. W. R. Sweany. Mr. Couzens has held positions with the Corporations of Taunton, Bristol, West Ham and Hampstead.

Mr. Henry Floy is expected to arrive in New York on the *Kaiserin Auguste Victoria* April 26, on his return from a combined pleasure and business trip to Europe. Mr. Floy visited Italy, inspecting electric-railway operation and the effect of fare zones, and made observations on construction in most of the principal cities. He inspected the underground trolley system in Vienna, the Prussian government's single-phase, 10,000-volt railway at Bitterfeld, and the 60,000-volt underground cable transmission system.

Mr. R. F. Morkhill has been appointed signaling engineer of the Grand Trunk Railway Company, with offices at Montreal, Que., succeeding Mr. C. A. Dunham, who recently resigned. Mr. Morkhill was until six years ago in charge of the signaling on the Central South Africa Railway, organizing the signal department of that road after the war. He became an assistant engineer in the constructon of the Pennsylvania's New York terminals, later joining the Railway Signal Company of Canada, Ltd., which he served as sales manager and as assistant general manager.

Mr. David Daly has been appointed manager of the Galveston-Houston Electric Railway, Galveston, Tex., besides acting in his present capacity as manager of the Houston Electric Company. Mr. Daly was born in Boston, Mass., Oct. 16, 1878, and was educated in the public schools of that city and at Harvard. He entered the employ of the Stone & Webster Engineering Corporation, and after serving with the company in Boston in various capacities was sent by Stone & Webster to Ponce, P. R., as local manager there of the Ponce Railway & Light Company. Returning to the United States in 1905, he was appointed manager of the Houston Electric Company.

Mr. Howard W. Leitch, the newly appointed electrical superintendent of the United Electric Light & Power Company, which supplies alternating-current service in New York City, was graduated from the Brooklyn Polytechnic Institute in 1895. Following graduation, he was employed at the Twenty-sixth Street station of the New York Edison Company as brushman and remained as repairman and operator until 1902. He then entered the employ of the Interborough Rapid Transit Company, but after a few months with it he returned to the New York Edison Company, being assigned to the Waterside station. He was made chief operator in 1906, assistant electrical superintendent in 1907 and assistant superintendent in 1909, retaining the last position until his appointment with the United company. Mr. Leitch is a member of the American Institute of Electrical Engineers.

Mr. Frank E. Watts, reigning Jupiter of the Jovian Order, will join the advertising staff of the *Electrical World* on May 1. Mr. Watts was born in Sunbury, Ohio, in 1878, and received his education in the public schools of Delaware County, Ohio, Wesleyan University and Ohio Northern University. Following eight years of teaching and two years' experience in selling machinery, Mr. Watts entered the incandescent-lamp business in August, 1907, and for some time he has been manager of the Sunbeam lamp department of the Western Electric Company. Mr. Watts served as statesman of the Jovian Order for New York and was largely responsible for the success of the Jovian Lunch Club of that city. He was elected Jupiter at Pittsburgh in October of last year. Mr. Watts lives at West Orange, N. J., and is a member of the Ohio Society of New York and the Essex County Country Club.

FRANK E. WATTS

Obituary

George P. Brophy, one of the founders of the Ottawa Electric Railway and the Ottawa (Ont.) Electric Company, superintendent engineer of the Ottawa river works and one of the most prominent figures in the capital, died at his late residence in Ottawa on Friday, April 4, of heart trouble, in his sixty-fifth year.

Victor Dwelshauvers-Dery, the distinguished Belgian scientist whose researches in steam-engine phenomena have been far-reaching in their effects on the development of this apparatus, died March 5 at Liège, Belgium, at the age of seventy-seven. He made valuable observations as to the possible usefulness of steam-jacketing and of superheated steam and emphasized the importance of dry steam. Mr. Dwelshauvers-Dery at seventeen studied in Brussels and later received the degree of mechanical engineer from the University of Liège, of which he became rector in 1900. In 1905 he prepared a memoir on the mechanical antiquities of Belgium, and also edited a historical report on the mechanical progress of Belgium from 1830 to 1905. He was an honorary member of the American Society of Mechanical Engineers.

Construction

New England

BIDDEFORD, MAINE.—A. B. Leach & Co., of New York, N. Y., acting for the Cumberland County Pwr. & Lt. Co., of Portland, Maine, has purchased the property of the York County Pwr. & Lt. Co., including the York County Lt. & Ht. Co. and other corporations of a similar nature, doing business in the counties of York and Cumberland and in the towns of Fryeburg, Porter and Hiram in the county of Oxford.

LACONIA, N. H.—The Laconia Gas & El. Co. has petitioned the Public Service Commission for permission to extend its transmission lines into the town of Sanbornton.

CLINTON, MASS.—The Clinton Gas Lt. Co. has applied to the State Board of Gas and Electric Light Commissioners for permission to issue $100,000 in capital stock. The company is planning to make repairs and extensions to its system.

EASTHAMPTON, MASS.—The Easthampton Gas Co. has petitioned the State Board of Gas and Electric Light Commissioners for permission to increase its capital stock by $100,000, making a total of $450,000.

PROVIDENCE, R. I.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 14, for a conduit and wiring system, lighting fixtures, etc., in the United States post office, court house and custom house at Providence, R. I., in accordance with specifications and drawings, copies of which may be obtained at the above office or at the office of the custodian, Providence. O. Wenderoth is supervising architect.

PROVIDENCE, R. I.—The contract for the erection of the addition to the power plant of the Rhode Island Co. on Manchester Street has been awarded to William H. Hamlyn & Son. An addition will be erected on the north side, 35 ft. wide and 160 ft. long, to provide room for new electrical equipment, and an addition to the west end, 72 ft. wide and 150 ft. long, will be erected, where a battery of boilers and two new turbines will be installed. The cost of the improvements is estimated at $750,000.

DANIELSON, CONN.—The Burgesses are considering the question of replacing the present arc-lamp lighting system throughout the borough with Mazda tungsten lamps. Arc lamps on Main Street have been replaced by tungsten lamps. The People's Lt. & Pwr. Co., of Danielson, furnishes the street-lighting service.

DERBY, CONN.—Plans are being considered for improvements to the street-lighting system which require an additional expenditure of $600 per year.

Middle Atlantic

CICERO, N. Y.—The Public Service Commission has authorized Fred J. Auburn, of Cicero, to exercise a franchise for furnishing electricity in the town of Cicero and the village of Brewerton.

FREDONIA, N. Y.—The Niagara & Erie Pwr. Co. has submitted another proposition to the Board of Trustees to furnish energy to operate the municipal electric-light plant. Earlier in the year the company offered to take over the plant and furnish the street-lighting service at a specified price per lamp. Under the new proposition the village would retain control of the plant and street-lighting system.

GLEN COVE, N. Y.—The Glen Cove Lt. & Pwr. Co. has applied to the Public Service Commission for permission to erect a transmission lines in Sea Cliff to supply electricity there.

ITHACA, N. Y.—The Ithaca El. Lt. & Pwr. Co. and the Ithaca Gas Lt. Co. have petitioned the Public Service Commission for permission to consolidate. The companies also ask for authority to execute a mortgage for $1,500,000 and to issue $429,000 in bonds thereunder to retire outstanding securities of the two companies and for new construction; also to issue $600,000 in capital stock. The J. G. White Co., of New York, N. Y., controls both plants.

MEXICO, N. Y.—The Public Service Commission has authorized the Mexico El. Co., of Mexico, to exercise franchises for furnishing electricity in the village of Mexico, the town of Mexico and the town of Palermo.

ALTOONA, PA.—The Penn Central El. Co., of Altoona, has entered into a contract to furnish electricity for lamps and motors for the Cambria Mines, located near Barnesboro. A branch will be erected to the mines from the Patton division of the transmission line from this city. About 200 hp will be furnished to the mines.

HARRISBURG, PA.—Charters were granted on April 12 for electric companies that will take in 31 boroughs and townships in Allegheny County. Each company will be capitalized at $5,000 and will take its name from the respective district in which it will operate. The incorporators are: H. C. Seidle, C. E. Theobald and G. R. Speer, of Pittsburgh.

HILLSVILLE, PA.—The Carbon Limestone Co., which operates extensive quarries near Hillsville, has decided to equip its entire plant for electrical operation. Electricity for operating the plant will be secured from the new power station of the Mahoning & Shenango Valley Ry. & Lt. Co.

INDIANA, PA.—Bids will be received by the Richard D. Kimball Co., 15 West Thirty-eighth Street, New York, N. Y., engineers, until April 28 for construction of a central heating and lighting plant, including power house construction, heating and electric work, generators, engines and boilers, for the State Normal School at Indiana, Pa. Plans and specifications can be seen at the office of the engineers, also at the office of J. Wood Clark, secretary of the Board of Trustees, Indiana, and at the office of Rutan & Russell, Pittsburgh, Pa.

LEBANON, PA.—The Lackawanna Iron & Steel Co. will equip two blast furnaces, located at Colebrook, for electrical operation, work on which will begin in the near future. The ore, coke, coal and stone handling devices will be equipped for electric-motor drive. Changes will be made in the electrical equipment in connection with the conveyors and coke ovens.

PHILADELPHIA, PA.—Estimates are being made for the construction of a power house, to be erected at Nineteenth Street and Allegheny Avenue, for the Electric Storage Battery Co.

PHILADELPHIA, PA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 14 for two engines and generators in the United States post office and court house, Philadelphia, Pa., in accordance with specifications and drawings, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

PITTSBURGH, PA.—The Duquesne Lt. Co., successor to the Allegheny County Lt. Co., has taken over nearly all the lighting companies in the boroughs and townships in Allegheny County. Embraced in the merger with the Duquesne Lt. Co. are the following separate electric-light companies: The Pittsburgh City Lt. & Pwr. Co., the St. Clair El. Co., Mount Oliver El. Lt. Co., Carrick Lt. Co., Baldwin Township and Mount Lebanon Township El. Lt. Co. The Pittsburgh City Lt. & Pwr. Co. recently acquired franchises in the various South Hills boroughs and townships and separate light companies were organized.

ROYALTON, PA.—Bids will be received by the Borough Council until May 15 for the installation of a new street-lighting system. Electricity for maintaining the system will be obtained from the York Haven Wtr. & Pwr. Co., of York Haven.

VERSAILLES, PA.—The Borough Council has awarded the Duquesne Lt. Co. a contract for lighting the streets of the borough. Under the new contract many of the arc lamps now in use will be replaced with tungsten lamps.

LAKEWOOD, N. J.—The Commonwealth Wtr. & Lt. Co., of Summit, N. J., has been granted authority by the Board of Public Utility Commissioners to issue $20,000 in bonds, the proceeds to be used for extensions to the plant of the Lakewood Wtr., Lt. & Pwr. Co., a subsidiary corporation.

PENNS GROVE, N. J.—The Board of Public Utility Commissioners has granted the Penns Grove El. Lt., Ht. & Pwr. Co. permission to erect transmission lines and distributing systems in Upper Penns Neck and Oldmans Townships.

PERTH AMBOY, N. J.—The Board of Education will receive bids until May 1 for electric-lighting fixtures for the addition to the Grammar School, Manual Training Building and heating plant. Specifications are on file at the office of Jesse Colyer, secretary of the board.

ABINGDON, VA.—The capital stock of the Abingdon Wtr. & Lt. Co. has been increased from $25,000 to $50,000.

CHARLOTTESVILLE, VA.—The Charlottesville & Albemarle Ry. Co. is planning to build a new power plant near Charlottesville. Contracts have been placed for the equipment of the plant with the exception of three 400-hp high-pressure boilers. The old plant will be abandoned when the new station is completed. The company will also purchase six new semi-convertible cars. Contracts for construction of plant will be awarded at once. Neff & Thompson, of Norfolk, are engineers in charge. John L. Livers is manager.

WASHINGTON, D. C.—Bids will be received at the office of the Commissioners of the District of Columbia, Washington, D. C., until May 5 for furnishing one 25-hp fuel engine with generator directly connected for use in the Water Department. Specifications and form of proposal may be obtained from the purchasing officer, room 320, District Building, Washington, D. C.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 28 for two high-pressure water-tube boilers at the Bureau of Engraving and Printing, Washington, D. C., in accordance with specifications and drawings, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 15 for furnishing special lighting fixtures for the new United States post office at Washington, D. C., in accordance with the specifications and drawings, copies of which may be obtained at the above office. O. Wenderoth is supervising architect.

WASHINGTON, D. C.—Bids will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until May 13, for furnishing at the various navy yards the following supplies: Brooklyn, N. Y., Schedule 5380—1500 ft. interior-communication cable; Washington, D. C., Schedule 5365—One electric conveyor; Newport, R. I., Schedule 5364—One motor-driven planer. Applications for proposals should designate the schedules desired by number. T. J. Cowie is paymaster general U. S. N.

North Central

DETROIT, MICH.—The Trojan Laundry Co. is planning to rebuild its plant, which was recently destroyed by fire. The company, it is said, will rebuild on a large scale and expects to purchase a generator for its power plant.

GRAND RAPIDS, MICH.—A complete lighting plant will be erected at the West Michigan State Fair grounds and a new lighting system installed. Incandescent lamps hung in arches will illuminate the streets of the grounds.

HARBOR SPRINGS, MICH.—The Township Board has granted the Cheboygan El. Lt. & Pwr. Co. a franchise to construct and operate an interurban electric railway in Harbor Springs. The franchise must be approved by the voters at the spring election.

MOUNT CLEMENS, MICH.—Contracts have been awarded for wiring the county infirmary. The Eastern Michigan Edison Co. will erect a transmission line to the institution to supply electricity there.

MOUNT CLEMENS, MICH.—The Eastern Michigan Edison Co., of Detroit, is putting in foundations for a tower substation at Chesterfield Station. The station is being built to furnish electricity to the Chesterfield Creamery, which has abandoned its steam plant. In addition farmers within a radius of half a mile will be supplied with electricity for lamps and motors.

PONTIAC, MICH.—A movement has been started by property owners on Huron Street for the installation of an ornamental street-lighting system on that thoroughfare.

PORT HURON, MICH.—A movement is on foot among the business men to install ornamental street lamps on Military, Water and Huron Streets, provided the city will furnish electricity to maintain the lamps.

READING, MICH.—Arrangements have been made for improvements to the municipal electric-light plant, including the installation of two 150-hp high-pressure tubular boilers, one 125-kva, three-phase, 60-cycle, 2200-volt generator and engine directly connected; also switchboard equipment for two units. Bids will be received until May 20 (Edgar G. Doud, village clerk) for the boilers and piping for the electric-light and water-works plant. Specifications may be obtained upon application to B. K. Goodman, chief engineer of the municipal electric-light and water-works plant.

CLEVELAND, OHIO.—Bids will be received at the office of the secretary of the director of public service, 104 City Hall, Cleveland, until May 5 for furnishing gas and electric light fixtures for the Lakeside Fire Service Station, Water Department, specifications for which may be obtained at the office of the superintendent of the water department. W. J. Springborn is director of public service, and W. H. Kirby is secretary to the director of public service.

CLEVELAND, OHIO.—At a meeting of the stockholders of the Cuyahoga Pwr. Co. to be held May 5 a vote will be taken on the proposition to increase the capital stock from $10,000 to $5,000,000. The company contemplates developing the water-power of the Cuyahoga River to generate electricity to be transmitted to Cleveland, Akron, Youngstown, Kent and other cities in this section of the State. W. R. Kimball, of New York, N. Y., is president of the company.

COLUMBUS, OHIO.—Bids will be received at the office of the Board of Trustees, Ohio State University, Columbus, Ohio, until May 12, for furnishing material and labor for the construction of the following work: (1) For an underground tunnel, approximately 653 ft. long; (2) for two automatic underfeed stokers in the power plant of the Ohio State University; (3) for heating, ventilating and plumbing in the new botany and zoology building; (4) for insectary and greenhouse (bids to be on completed units). Plans and specifications for the above improvements are on file at the office of the auditor of state and also may be seen at the office of Joseph N. Bradford, university architect, the chief engineer and the secretary of the Board of Trustees. Carl E. Steeb is secretary.

DEFIANCE, OHIO.—The Auglaize Pwr. Co., of Defiance, is planning to build an extension 322 ft. long to its dam across the Auglaize River, to take the place of the 120-ft. earthen wing, which was destroyed by the recent flood. The extension will be built of solid concrete, with a gate at the west end.

IDLEWOOD, OHIO.—Bids will be received by the Mayor and village clerk until April 30 for furnishing and installing an electric-lighting system and maintaining same for the village of Idlewood for a period of ten years. The plans provide for the installation of 25 street arc lamps. Specifications are on file at the office of the clerk. Idlewood has not a post office. E. A. Burr is clerk.

LISBON, OHIO.—The power house of the Duquesne Coal Co. at Newhouse, located 5 miles east of Lisbon, was recently destroyed by fire.

LOUDONVILLE, OHIO.—Bids will be received until May 7 for improvements to the municipal electric-light and water-works station, with the exception of Specification E, which covers one motor-driven centrifugal pump. Specifications covering pumps will be furnished at a later date. Bids were advertised to be received until April 7, but owing to the recent high waters this date was postponed. The Capitol Engineering Co., Union National Bank Building, Columbus, has charge of the engineering work.

MARIETTA, OHIO.—The Parkersburg, Marietta & Interurban Ry. Co. is still furnishing electricity for lighting the streets of the city. The municipal electric-light plant is a total wreck. The only machine that can possibly be saved is the one that fed the arches. Charles A. Brown is superintendent of the municipal electric-light plant.

MAUMEE, OHIO.—The Valley Lt. & Pwr. Co., which was recently incorporated to take over the property and business of the Suburban Lt. & Pwr. Co. and the Maumee Valley El. Co., has been granted permission by the Public Service Commission to issue $96,000 in bonds and $97,100 in capital stock. The company furnishes electricity in Maumee and Perrysburg, but owing to three breaks in the Miami and Erie Canal, between Waterville and Grand Rapids, caused by the recent flood, the two villages are securing electric service from the Toledo Ry. & Lt. Co. The Valley company will rebuild many of the present lines and will erect new lines to Rossford and Halsted Heights. About $40,000 will be expended for improvements and extensions. Eugene Rheinfrank will be manager of the Valley Lt. & Pwr. Co.

OAKLEY, OHIO.—Plans are being prepared by Zettel & Rapp, architects, Johnson Building, Cincinnati, for an addition to the factory power building of the Factory Pwr. Co. in the factory colony at Oakley, which will provide immediately for 500 hp, with provision for duplicating the same. The plans provide for immediate equipment of a portion of the plant. Provision is also made for a series of concrete coal hoppers, which are to be installed immediately. The Factory Pwr. Co. furnishes power for numerous plants in the factory colony.

PUT-IN BAY, OHIO.—The Put-In Bay Improvement Co. has awarded the contract for engines for its plant to Fairbanks, Morse & Co., of Cleveland, Ohio. The contract for wiring and poles was given to the Electric Equipment Co., of Sandusky. About 100 meters, 20 arc lamps and from 8000 to 10,000 incandescent lamps will be required. The company has not yet engaged an engineer or placed contracts for electrical supplies. The cost of the plant is estimated at about $15,000. Henry Fox is president of the company and M. Ingold general manager.

VAN BUREN, OHIO.—Plans are being considered for the installation of an electric-lighting system here. The Village Council has accepted the proposition submitted by the North Baltimore Ser. Co. to extend its transmission line to Van Buren and furnish electricity for lamps.

WARRENSVILLE, OHIO.—Bids will be received at the office of the director of public safety, 109 City Hall, Cleveland, until May 1 for the electric-wiring work in connection with hospital building No. 2, Tuberculosis Sanitarium Group, and the women's building, Correction Square Group, Warrensville, Ohio, in accordance with plans and specifications which may be seen at the office of J. Milton Dyer, architect, 825 Cuyahoga Building, Cleveland. Charles W. Stage is director of public safety.

HARRODSBURG, KY.—Improvements are contemplated to the municipal electric-light plant to enable it to furnish a 24-hr. service. It is proposed to furnish a power service for industrial plants.

PIKEVILLE, KY.—The Consolidation Coal Co., of Fairmont, W. Va., has entered into a contract with L. L. Stone to furnish electricity for distribution in Pikeville from its plant at Jenkins, Ky. The company will erect the transmission line between Jenkins and Pikeville.

COLUMBUS, IND.—Plans are being prepared by the Interstate Pub. Ser. Co., which recently took over the property of the Central Indiana Ltg. Co. in Columbus and Bloomington, for general improvements to the system. The capital stock of the Interstate company has been increased from $3,000,000 to $8,000,000. Chester P. Wilson is president of the Interstate company.

NORTH LIBERTY, IND.—The Town Board of North Liberty is reported to be considering the installation of an electric-light system. It is proposed to secure electricity from the Plymouth El. Lt. & Pwr. Co., of Plymouth.

WALKERTON, IND.—Arrangements have been made between the City Council and the Plymouth El. Lt. & Pwr. Co. whereby the latter will furnish electricity to operate the municipal electric system. The company agrees to erect and maintain the transmission line from Plymouth to Walkerton at its own expense. Application has been made by the Plymouth company to the County Commissioners for a franchise from the county line to Walkertown.

ALVIN, ILL.—The Hoopeston Gas & El. Co., of Hoopeston, has been awarded a contract for street lighting here. The contract calls for 20 street lamps. The Farmers' Elevator Co. will use electricity to operate the machinery of its plants. The Hoopeston company will erect a transmission line from Rossville to Alvin to supply the service.

BROCTON, ILL.—The Village Board has granted the Central Illinois Pub. Ser. Co., of Mattoon, a franchise to furnish electricity for lamps and motors in Brocton. The company is seeking a contract for lighting the streets of the village.

CHICAGO, ILL.—The State Street Improvement Association, which is working in conjunction with the Association of Commerce and City Electrician Ray Palmer, is planning for the installation of 200 ornamental arc lamps on that thoroughfare between Lake and Van Buren Streets. The improvement associations of Monroe Street and Clark Street are also planning for the installation of ornamental lamps on those streets. H. A. Stewart is consulting engineer for the State Street Improvement Association.

DIXON, ILL.—The merchants in the downtown district are raising funds for the installation of 40 ornamental street lamps.

ELGIN, ILL.—Plans are being considered by John S. Russell, commissioner of public property, for extensions to the ornamental street-lighting

system on Douglas Avenue to North Street, Chicago Street to Geneva, Villa Court, and Du Page Street to Villa Street.

FIATT, ILL.—The Farmington Lt. & Pwr. Co., of Farmington, has secured contracts for furnishing electricity for lamps for residences and business houses in Fiatt, and also to furnish energy to operate the machinery in the Fiatt Mine, and for the local elevator. Extension will be made from the line that runs from Cuba to Fairview.

HILLSBORO, ILL.—The Southern Illinois Lt. & Pwr. Co., successor to the Hillsboro El. Lt. & Pwr. Co., is contemplating further development to its system, involving an outlay of about $500,000, most of which will be expended during the coming summer in extensions to its transmission and railway lines. The transmission lines will be extended from Morrisonville to Palmer and from Coffeen to Fillmore, and the electric railway will be extended from Hillsboro to Nokomis. The company also proposes to install a gas system in Hillsboro, if granted a franchise, to cost from $60,000 to $75,000. The officers of the company are: J. J. Frey, president; W. A. White, vice-president; B. H. Walcher, secretary, and C. Charles A. Ramsey, treasurer.

HOOPESTON, ILL.—The Hoopeston Gas & El. Co. is contemplating extending its transmission line from Hoopeston to Ambia, Ind.

JACKSONVILLE, ILL.—At an election held recently the proposition to issue $50,000 in bonds for improvements to the municipal electric-light plant was defeated.

LEXINGTON, ILL.—The property of the Lexington El. Lt. Co. has been purchased by Cash M. Harlan from the receiver. Mr. Harlan will not take over the plant until June 1. It is understood that improvements will be made to the plant. J. W. Van Dolah is manager.

SILVIS, ILL.—The Village Board has awarded the People's Pwr. Co., of Moline, a five-year contract for lighting the streets of the village and for pumping the water supply. The contract calls for three arc lamps and 51 tungsten lamps. Tungsten lamps will be substituted for the arc lamps in the residential districts.

SPRINGFIELD, ILL.—The Springfield Lt., Ht. & Pwr. Co. and the Springfield Gas Lt. Co. have been consolidated under the name of the Springfield Gas & El. Co. The capital stock will be increased to $3,000,000. B. C. Cobb, of New York, N. Y., is president, and Harry T. Willett, of Springfield, secretary of the new company.

URBANA, ILL.—The Urbana Park Commissioners are contemplating the installation of an electric-light plant to furnish electricity for lighting Crystal Lake, Leal and Carl Parks. Should the plant be installed it will be located at Crystal Lake Park, where the waste steam could be used for furnishing heat for the pavilion.

WARSAW, ILL.—The Stone & Webster Corpn., of Boston, Mass., which recently purchased the local electric-light plant, it is reported, will expend about $20,000 in improvements to the plant. A new brick substation, to cost $5,500, will be erected and an ornamental street-lighting system will be installed on Main Street.

EDGERTON, WIS.—The residents of Albion have petitioned the Edgerton El. Lt. Co. to extend its electric light and power service to that village.

GREEN LAKE, WIS.—J. R. Stewart, of Ripon, Wis., who was recently granted a franchise to install an electric-light plant in Green Lake, is reported to be asking for bids for construction of the proposed plant. William L. Walker is president.

LONE ROCK, WIS.—At an election held recently the proposition to issue $5,000 in bonds for the construction of an electric-light plant was carried.

MILWAUKEE, WIS.—The National Avenue Advancement Association is contemplating the installation of an ornamental street-lighting system on National Avenue.

NEKOOSA, WIS.—The Nekoosa-Edwards Lt. & Pwr. Co. has applied for a franchise to supply electricity for lamps and motors in Nekoosa.

HARDWICK, MINN.—The Village Council has decided to install an electric-light plant and establish a 24-hour service. The proposed plant will be of the storage-battery system. Bids have been asked for the plant and equipment.

RENVILLE, MINN.—The City Council has granted the Lethert El. Co., of St. Paul, a 20-year franchise to install and operate an electric-light plant in Renville. The company agrees to furnish a 24-hour service.

ST. PAUL, MINN.—Bids will be received at the office of the Ramsay County Board of Control, St. Paul, Minn., until May 1 for plumbing, heating, electric work and electric elevator for the tuberculosis pavilion at the City and County Hospital, in accordance with plans and specifications prepared by Clarence H. Johnson, architect, now on file in the office of the Board of Control. Oliver J. Tong is secretary of board.

TWIN LAKES, MINN.—Plans are being considered for the installation of an electric-light plant and a co-operative laundry. It is proposed to operate the electric-light plant and the laundry in conjunction with the creamery. The Twin Lake Creamery Co. is interested in the project.

BLANCHARD, IA.—The Lee El. Lt. Co., of Clarinda, is planning to install an electric-light system in Blanchard. The company will extend its transmission line from Clarinda through College Springs to Blanchard.

BLOOMFIELD, IA.—We are informed that the city of Bloomfield does not contemplate the construction of a new electric-light plant, as reported in these columns in the issue of April 12. A. B. Welch is city clerk.

CEDAR FALLS, IA.—The City Council has instructed the city engineer to prepare plans for the construction of a municipal electric-light plant, for which bonds to the amount of $50,000 have been voted.

CRESTON, IA.—The Creston Mutual El. Lt., Ht. & Pwr. Co. has decided to install new machinery, which will double the output of the plant. The new equipment will consist of a 750-hp engine, boiler, generator, switchboard, etc., to cost about $28,000. Contracts will probably be awarded within 30 days. The company recently entered into a contract to furnish electricity to operate the municipal electric-light system in Afton.

CUMBERLAND, IA.—The installation of an electric-lighting system in Cumberland is under consideration.

DE SOTO, IA.—The installation of an electric-lighting system in De Soto is under consideration.

FORT MADISON, IA.—A new company has been organized by the Stone & Webster interests to be known as the Fort Madison El. Co. The company is capitalized at $150,000 and will take over the property of the Fort Madison El. Lt. & Pwr. Co., recently purchased by J. A. Trawick. The directors are: J. A. Trawick, A. S. Nichols, J. O. Boyd, S. W. Trawick, R. W. Child, W. G. Ross and George B. Stewart.

HUMBOLDT, IA.—Plans are being considered for lighting the business district in Humboldt with electroliers.

LORIMER, IA.—N. W. Lovegrove, of Des Moines, has been granted a franchise to furnish electricity for lamps and motors in Lorimer.

VAN METER, IA.—The question of issuing bonds for the installation of an electric-light plant in Van Meter is under consideration.

VINTON, IA.—The Cedar Rapids & Iowa Ry. & Lt. Co., of Cedar Rapids, has submitted a proposition to the city of Vinton offering to furnish electricity to operate the municipal electric-light system at 3.2 cents per kw for the first 25,000 kw and all in excess of that amount at 2.7 cents.

ALBANY, MO.—At an election to be held April 29 the proposition to issue $19,000 in bonds for the construction of an electric-light plant will be submitted to a vote.

ST. LOUIS, MO.—The Electric Co. of Missouri, successor to the Suburban El. Lt. & Pwr. Co., has purchased the electric-light plants in Pacific, Union and Washington and will supply energy from the Keokuk dam. The new company has taken over the property of the Mississippi River Pwr. Distributing Co., which owns the equipment in St. Louis County for delivering current from Keokuk, including the large substation on Page Avenue, near the St. Louis limits. S. H. Wallace, of Webster Groves, is secretary of the new company.

FARGO, N. D.—Samuel F. Crabbe, of Fargo, architect, has been engaged to prepare plans for a heating and power plant for the State.

FARGO, N. D.—The Village Board of Dilworth has entered into a contract with the Union Lt., Ht. & Pwr. Co., of Fargo, for the installation of a street-lighting system in that village. The contract is for a period of three years and calls for 12 lamps of 32 cp.

LISBON, N. D.—The City Council has granted I. I. Bennett, of Sioux Falls, a franchise to install and operate an electric-light plant in Lisbon. M. E. Moore is city auditor.

ARMOUR, S. D.—Bonds to the amount of $15,000, it is reported, have been voted for the installation of an electric-light system.

FRANKFORT, S. D.—Plans are being considered for the installation of an electric-lighting system in Frankfort.

INTERIOR, S. D.—John Farnham is installing an electric-light plant in Interior.

TRIPP, S. D.—The local electric-light system has been purchased by Richard and Christopher Vetter. It is understood that the new owners will improve and extend the system.

WHITE, S. D.—At an election held April 15 the proposition to issue $18,000 in bonds for the construction of an electric-light plant and waterworks system was carried. R. E. Cameron is auditor.

GENOA, NEB.—The Nebraska Pwr. Co. has completed the first unit of its hydroelectric power plant on the Loup River and is furnishing energy to operate the local electric-light plant. Plans are being prepared for additional units which will develop 16,000 hp. The third plant will develop 40,000 hp. H. E. Babcock, of Columbus, is interested in the company.

OXFORD, NEB.—Bids will be received by the chairman and Board of Trustees of the village of Oxford until May 9 for the construction of a municipal lighting plant as follows: One 50-hp fuel oil engine, one 30-kw, direct-current, three-wire, 125-250-volt slow-speed generator, one three-panel switchboard (slate), one 240-amp-hr. storage battery, one 10-in. double leather belt and brick power station; also one 20-hp, 220-volt, direct-current motor and one 10,000-gal. fuel-oil tank, 7½ ft. by 30 ft., and miscellaneous line material. The cost of the plant, not including the fuel-oil tank and direct-current motor, is estimated at $8,950, and the cost of the tank and motor is estimated at $1,100. Plans and specifications are on file at the office of W. T. Pettygrove, village clerk, and Charles F. Sturtevant, of Holdrege, consulting engineer.

ST. PAUL, NEB.—S. B. Knudson is reported to be interested in a project to develop a power canal at St. Paul. The project includes the erection of a power house. It is expected to have the plant in operation by June 1.

STEINHAUER, NEB.—Bonds to the amount of $7,000 have been voted for the installation of a municipal electric-light plant in Steinhauer.

WESTERN, NEB.—The installation of an electric-light plant in Western is under consideration by the Commercial Club.

AUGUSTA, KAN.—At an election held recently the proposition to issue $5,000 in bonds for the municipal electric-light plant was carried. This will be added to the $8,000 the city already has on hand.

BEATTIE, KAN.—The local electric-light plant, which was recently burned, is to be rebuilt. New machinery has been purchased and work will soon begin on construction of the plant. A larger generator will be installed. Electrical service was also furnished by the plant in Home City, 6 miles west of the town. Prior to the burning of the plant plans had been perfected for extending the service to Summerfield, 12 miles northeast of Beattie. Harry D. Hockman is proprietor.

CEDAR POINT, KAN.—Bonds have been voted for the installation of a municipal electric-light plant in Cedar Point.

GARDEN CITY, KAN.—The City Council has passed an ordinance authorizing the sale of $40,000 in bonds for the installation of a municipal light plant.

KANSAS CITY, KAN.—The city commissioners have decided to submit the proposition to issue $150,000 in bonds for extensions to the municipal electric-light plant. It is proposed to purchase another steam turbine and to extend the system into the Seventh Ward, formerly Argentine.

MADISON, KAN.—Bonds to the amount of $35,000 have been voted for the installation of an electric-light plant and water-works system. The electric plant will have a generating capacity of about 50 kw and will be driven by an oil engine. The street-lighting system will consist of about 50 incandescent lamps of 100 cp. Rollins & Westover, Midland Building, Kansas City, Mo., are consulting engineers. Bids for construction of plant will be asked for about May 15.

SCOTT, KAN.—The City Council is considering the construction of an electric-light plant and water-works system, plans for which were prepared by the Alamo Engine & Supply Co., of Omaha, Neb. Charles A. Kitson is Mayor.

Southern States

CHERRYVILLE, N. C.—The proposition to issue $5,000 in bonds for the installation of a municipal electric-light plant will be submitted to the voters on May 5.

VADE MECUM, N. C.—Preparations are being made for the construction of a large dam and electric-light plant at Vade Mecum Springs to supply electricity for the hotels there. J. C. Tise, of Winston-Salem, is owner of the property.

WILSON, N. C.—At an election held recently the proposition to issue $80,000 in bonds for improvements to the municipal electric-light plant was carried. It is proposed to increase output of plant to 1500 hp. The plant is operated by steam power. Bids for the proposed work will be called for in about 60 days. R. J. Grantham, of Wilson, has charge of the engineering work.

ATLANTA, GA.—The Water Board and finance committee of the Council have recommended to the City Council the acceptance of the bid of the Georgia Ry. & Pwr. Co. for furnishing electricity to operate the new centrifugal pump at the river station. The company offers to furnish the service at 6 mills per kw up to 3,500,000 kw per year, the city to guarantee consumption to an amount not less than $9,000 per year.

GUYTON, GA.—At an election held April 15 the proposition to issue $15,000 in bonds, the proceeds of $10,000 to be used for the installation of a water-works system and $5,000 for an electric-light plant, was carried. Bids for construction of plant will be called as soon as possible. The J. B. McCrary Co., of Atlanta, Ga., has charge of the engineering work. George T. Haywood is Mayor.

MACON, GA.—Work will soon begin on extensive improvements to the large power plant of the Central Georgia Pwr. Co., on the Ocmulgee River, 8 miles from Jackson. Two new generators will be installed, increasing the generating capacity of the plant from 12,000 hp to 24,000 hp.

ROCHELLE, GA.—At an election held recently the proposition to issue bonds for the installation of an electric-light plant and water-works system was carried. The contract will be awarded to the J. B. McCrary Co., of Atlanta.

CHIPLEY, FLA.—Bids will be received by A. A. Myers, president of the Chipley Lt. & Pwr. Co., Chipley, until May 20, for furnishing material and equipment for the construction of an electric-light plant in Chipley. The equipment will consist of one four-valve high-speed automatic engine with a rating of 115 hp, directly connected to a three-phase, 60-cycle, 2300-volt alternating-current generator. The company reserves the right to furnish the poles. Proposals will be received as follows: (1) For furnishing material and constructing the system complete; (2) for furnishing labor and constructing system, the company to supply the material and equipment for the whole work or any subdivisions scheduled under the bidding sheet. Plans and specifications are on file in the office of the company at Chipley, also in the office of Solomon-Norcross Co., engineers, Candler Building, Atlanta, Ga.

JACKSONVILLE, FLA.—The Pablo Pier Investment Co., recently incorporated with a capital stock of $100,000, is contemplating the installation of an electric-light plant in Jacksonville. Marcus Conant is president.

MIAMI, FLA.—The Forbes Pioneer Boat Lines Co. is contemplating the construction of an electric-light plant on Ritta Island, Lake Okeechobe.

LONE MOUNTAIN, TENN.—Plans are being prepared by D. R. Shearer, of Knoxville, for the construction of a hydroelectric power plant on Ball Creek for the purpose of furnishing electricity for lamps and motors in Lone Mountain and Tazewell.

MORRISTOWN, TENN.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 29 for the construction, including plumbing, gas piping, heating apparatus, electric conduits and wiring, interior lighting fixtures and approaches, of the United States post office at Morristown. Drawings and specifications may be obtained from the above office or from the custodian of site at Morristown. O. Wenderoth is supervising architect.

SHELBYVILLE, TENN.—The entire power plant of the Sylvan Cotton Mills Co., located 2 miles south of the town, was destroyed by fire recently, causing a loss of about $10,000.

MONTEVALLO, ALA.—The Montevallo Ice & Lt. Co. is planning to erect an electric-light plant and ice factory in Montevallo. The machinery for the plant has been purchased. S. Wagner, of York, Pa., is engineer in charge.

CONWAY, ARK.—Bids will be received by the Board of Trustees for the Arkansas State Normal School, addressed to B. W. Torreyson, secretary, Little Rock, until May 3 as follows: (1) For completion of the girls' dormitory building and erection of kitchen wing thereto; (2) for erection of power house; (3) for erection of model school building; (4) for construction of pipe conduits, sidewalks and certain concrete foundations; (5) for installation of a central heating plant, consisting of boiler and connections, underground piping and connections to buildings, piping and radiation in girls' dormitory and model school; (6) for extension of water mains through campus, location of hydrants and connection to buildings. Bids will be considered on the whole or on combinations of items. Plans may be seen at the office of J. J. Doyne, president, Conway, Ark., and may be obtained at the office of Charles L. Thompson, architect, Southern Trust Building, Little Rock. George B. Cook is chairman of board.

HOT SPRINGS, ARK.—Sealed proposals will be received at the office of the constructing quartermaster, Hot Springs, until May 5 for construction of Army Nurse Corps Home, including heating, plumbing, electric wiring and fixtures, at the Army and Navy Hospital in Hot Springs. Further information may be obtained upon application to the constructing quartermaster.

MARVELL, ARK.—The City Council has granted F. H. Webster a 25-year franchise to furnish electricity for lamps and motors in Marvell.

DE RIDDER, LA.—E. J. Legarden has been granted a franchise to construct and operate an electric-light plant in De Ridder.

LAFAYETTE, LA.—The contract for machinery and making improvements to the municipal electric-light plant and water-works system, bids for which were received April 9, has been awarded to Anderson Offutt, of New Orleans, La., for $24,675.

GIBSLAND, OKLA.—The installation of an electric-light plant in Gibsland is under consideration. F. Johnson is interested in the project.

STILLWATER, OKLA.—Plans are being prepared by the Oklahoma Public Ser. & Interurban Ry. Co. for the construction of a power house.

ATHENS, TEX.—The Citizens' El. Lt. & Pwr. Co. is building a new power plant in Athens.

BIG SPRING, TEX.—The West Texas El. Co. is planning to install additional machinery and equipment in its local electric light and power plant.

CAMERON, TEX.—The Cameron Wtr. Pwr. & Lt. Co. is planning to erect a pumping station and to make other improvements to its system.

DALLAS, TEX.—George L. Fearn, county auditor, is contemplating calling for bids for lighting the Oak Cliff viaduct in the near future.

EL PASO, TEX.—The Rio Grande Valley Trac. Co. has petitioned the County Commissioners of El Paso County for a 50-year franchise to erect transmission lines for the distribution of electricity throughout the lower valley.

LA PORTE, TEX.—Arrangements are being made for the construction of an electric-light plant and ice factory in La Porte. Philip J. Pfeiffer, president and general manager of the Jefferson El. Co., of Detroit, Mich., will have charge of construction of the plant.

SAN ANTONIO, TEX.—Plans are being considered by Alderman Lucas, chairman of the committee of public utilities, for the installation of a new street-lighting system on Houston and Commerce Streets. It is proposed to erect ornamental lamp standards carrying three-lamp clusters.

SAN ANTONIO, TEX.—Surveys for the proposed interurban line between San Antonio and Austin, a distance of 85 miles, will be completed about June 1, and construction work will be started soon after. The cost of building and equipping the railway, including power plant and rolling stock, is estimated at about $2,400,000. W. B. Tuttle is general manager.

Pacific States

SPANGLE, WASH.—An electric-lighting system is to be installed in Spangle during the summer by the Washington Wtr. Pwr. Co., of Spokane. A number of ranchers along the proposed route of the transmission line are planning to avail themselves of the service.

VANCOUVER, WASH.—Application has been made to the City Council by Dr. I. Sedgwick Putnam, of Vancouver, for a franchise to contsruct and operate an electric railway on various streets of the city. The parties interested in the project, it is said, propose to build interurban lines out of the city.

REDMOND, ORE.—The city lighting committee is planning the installation of cluster lamps in the business section and other lamps in the residence section.

ST. JOHNS, ORE.—The City Council has accepted the proposition submitted by the Washington Wtr. Pwr. Co., of Spokane, for a franchise and contract for lighting the city, subject to the approval of the city attorney.

YONCALLA, ORE.—Plans are being prepared by E. S. Benefiel, of Paisley, for the construction of a power plant, near Drain, for the purpose of supplying electricity for lamps and ultimately for motors. Work will soon begin on construction of the proposed plant.

CLOVERDALE, CAL.—The Cloverdale Lt. & Pwr. Co., of Cloverdale, and the California Tel. & Lt. Co., of Santa Rosa, have applied to the State Railroad Commission for an order empowering the former to sell its property to the latter. The California Tel. & Lt. Co. also asked for permission to issue $5,000,000 in bonds and to sell at this time bonds to the amount of $350,000. Of the proceeds it is proposed to use $228,000 to discharge existing obligations, $75,000 to purchase the property of the Cloverdale Lt. & Pwr. Co. and $17,000 for improvements.

LOS ANGELES, CAL.—The City Council has voted to install a new lighting system in South Park.

LOS ANGELES, CAL.—At the election held April 16 the proposition to issue $6,500,000 in bonds for the installation of a distribution system for aqueduct power was defeated.

LOS ANGELES, CAL.—The contract for furnishing lamp standards for the new lighting system on Sixth, Eighth and Ninth Streets has been awarded to the Llwellyn Iron Works, of Los Angeles, for $14,725. The conduit to feed the system will be laid in the near future.

LOS ANGELES, CAL.—Plans are being prepared for the construction of a pipe storage house, 95 ft. by 286 ft., to be erected on Macy Street, Los Angeles, for the H. R. Boynton Co. The building will be equipped with a complete electrically operated loading and conveying system. The United Engineering Co., M. Ray Costerisan, manager, American Bank Building, Los Angeles, is consulting engineer.

MARYSVILLE, CAL.—The Great Western Pwr. Co., of San Francisco, has been granted a franchise by the Board of County Supervisors to erect transmission lines for the distribution of electricty over the highways of Yuba County.

REDDING, CAL.—The franchise for the erection of transmission lines in Redding, bids for which were opened April 7, was purchased by Albert C. Agnew, of Oakland, for $100. Mr. Agnew also purchased the franchise for the erection of transmission lines on the roads and highways in Shasta County for $125, bids for which were opened April 7. It is understood that Mr. Agnew represents the Sierra Pwr. Co.

REDLANDS, CAL.—Bids will be received by the Board of Trustees for furnishing materials for the municipal water plant, including pumps, pipe, motors, wire and controlling equipment. The city of Redlands recently contracted with the Southern Sierras Pwr. Co., of San Bernardino, to furnish electricity to operate the pumps of the new water system. R. Warner is city clerk.

RIVERSIDE, CAL.—Important extensions to the municipal electric-light system have been provided for by the Board of Public Utilities, which include the erection of a new substation at Arlington to handle the power to be delivered to the city by the Southern Sierras Pwr. Co., an ornamental lighting system for Market Street, between Seventh Street and Whittier Place, and the installation of an ornamental lighting system in Brentwood Place. Among the extensions provided for is the erection of a transmission line from the proposed Arlington substation to Mockingbird Canyon to supply power to all the pumping plants along the Gage Canal.

SAN BERNARDINO, CAL.—The Empire Water Co., of San Bernardino, has applied to the State Railroad Commission for permission to issue $200,000 in bonds, the proceeds to be used for the construction of a hydroelectric power plant in the San Jacinto Mountains, near Coyote Creek.

SAN FRANCISCO, CAL.—The stockholders of the Pacific Gas & El. Co. have voted to issue $5,000,000 in bonds to provide funds for its extensive plans for construction and improvement in Northern California.

SANTA MONICA, CAL.—Plans are being prepared for the installation of an ornamental street-lighting system on San Vicente Boulevard, to cost about $5,000. Concrete standards may be used. J. A. Campbell and others are interested.

EMMETT, IDAHO.—The Beaver River Pwr. Co., of Bliss, contemplates extending its transmission lines into the Payette Valley to furnish electricity in this section. The company will apply for a franchise in Emmett.

POCATELLO, IDAHO.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until May 28 for the construction complete, including plumbing, gas piping, heating apparatus, electric conduit and wiring and lighting fixtures, of the United States post office and court house at Pocatello, Idaho. Drawings and specifications may be obtained from the custodian of site at Pocatello or at the above office. O. Wenderoth is supervising architect.

MOUNT PLEASANT, UTAH.—The contract for the construction of the municipal electric-light plant has been awarded to Lyman & Samuels, of Salt Lake City, for $25,312. The work includes the construction of a power plant in Pleasant Creek Canyon, the erection of 4 miles of transmission lines and remodeling the present distributing system.

COLUMBUS, N. M.—The village trustees have granted to C. E. Cooke, of El Paso, Tex., a franchise to install and operate an electric-light plant and water-works system in Columbus. The equipment of the electric plant will include a 25-hp Fairbanks, Morse & Co. engine and a 15-kw generator; a No. 2 Layne & Bowler two-stage pump will be installed to pump the water. The cost of both plants, including piping and wiring, is estimated at about $10,000.

LAS CRUCES, N. M.—The Las Cruces El. Lt. & Ice Co. is planning to install a 15-ton ice machine in its plant.

Canada

ALERT BAY, B. C.—The provincial government will build a telephone line from Campbell River to Alert Bay, a distance of 120 miles.

KAMLOOPS, B. C.—By-laws have been approved by the ratepayers authorizing an expenditure of $250,000 for construction of a hydroelectric power plant and $65,000 for improvements and extensions to the electric-lighting system. J. A. Wilson is city engineer.

SOUTH VANCOUVER, B. C.—The British Columbia El. Ry. Co. is planning to erect a new substation in South Vancouver to cost $90,000. The building will be of reinforced concrete, one story high, with gallery for switching apparatus. The equipment will consist of three motor-generator sets with a rating of 1000 kw each and transforming equipment for 7000 kw. The company has agreed to extend the electric railway from Earls Road, Westminster, to Joyce Road, Collingwood, immediately, and eventually to Boundary Road, Central Park, provided the municipality will agree to the conditions of the company.

VANCOUVER, B. C.—Requests are being made by the property owners on several streets for the installation of ornamental brackets for luminous arc lamps instead of the tungsten lamp standards. The cost of the proposed lamps is estimated at about $218 each. City Electrician Fletcher has charge of the work.

BARRIE, ONT.—Anticipating the advent of hydroelectric power from the Severin River, it is proposed to discard the present arc-lamp lighting system on the principal streets and substitute about 500 incandescent lamps. These would probably be attached from arms on the poles already erected.

HANOVER, ONT.—The Hanover El. Lt. & Pwr. Co. contemplates installing meters in the near future. The flat-rate system now in use will be discarded.

MERLIN, ONT.—Estimates are being secured for the installation of an electric-light plant in Merlin.

STAYNER, ONT.—The town has purchased the local electric-light plant. Electricity for operating the system will be purchased from the Hydro-Electric Power Commission of Ontario.

AYLMER, QUE.—The town of Aylmer is contemplating the installation of a complete electric-lighting system, to cost approximately $30,000.

MEGANTIC, QUE.—The corporation of Megantic has engaged Edward A. Evans, of Quebec, to prepare plans for a hydroelectric power plant to furnish electricity for lamps and motors for the town. The proposed dam will probably be about 65 ft. high. Megantic has not a post office.

MONTREAL, QUE.—The Cedar Rapids Mfg. & Pwr. Co., of Montreal, has awarded the contract for the construction of the hydroelectric development at Cedars, to cost over $3,000,000, to Fraser, Brace & Co., of New York, N. Y. The work will include the completion of the canal and building the power-house substructure. The initial installation under the contract provides for 100,000 hp, the work to be completed by October, 1914. This contract does not include machinery, for which negotiations are under way. The hydraulic work will be done under the supervision of Julian C. Smith, chief engineer of the Shawinigan Wtr. & Pwr. Co. R. M. Wilson, chief engineer of the Montreal Lt., Ht. & Pwr. Co., will have charge of the installation of the electrical machinery.

New Industrial Companies

THE BORG & BECK COMPANY, of Moline, Ill., has been incorporated by Charles W. and George W. Borg and Marshall Beck. The company is capitalized at $80,000 to manufacture machinery and motors.

THE CLARK ENGINEERING COMPANY, of Brooklyn, N. Y., has been incorporated with a capital stock of $40,000 to do a general electrical contracting business. The incorporators are: Royal S. Clark, Luiford S. Stiles and Wallace A. Jack, 359 St. John's Place, Brooklyn, N. Y.

THE INLAND ELECTRIC COMPANY, of Indianapolis, Ind., has been incorporated with a capital stock of $35,000 to deal in electrical supplies.

The incorporators are: James H. Drew, Charles P. Greenen and B. G. Drew.

THE JANDONS ELECTRIC EQUIPMENT COMPANY, of New York, N. Y., has been incorporated with a capital stock of $10,000 by Louis Freed, B. Freed and Gustav Silverman, 445 East One Hundred and Seventy-ninth Street, New York. The company proposes to do a general electrical contracting business.

THE METAL TREATING & EQUIPMENT COMPANY, New York, N. Y., has been incorporated with a capital stock of $100,000 for the purpose of exploiting its patented processes and solutions for electro-galvanizing, both in the form of installing job galvanizing plants and installing special plants. The officers are Guido M. Sacerdote, president; Lewis E. De Neergaard, vice-president, and Louis A. Freedman, secretary and treasurer. The offices of the company are located at 1784 Broadway, New York, N. Y.

THE PUBLIC UTILITIES CONTRACTING COMPANY, of New York, N. Y., has been chartered with a capital stock of $25,000 by E. F. Miller, J. F. Hughes and R. F. Corcoran, 104 West Seventy-second Street, New York, N. Y.

THE WOLFRAM WIRE COMPANY, of Wilmington, Del., has been incorporated with a capital stock of $1,000,000 by Otto P. Amend, 205 Third Avenue, New York, N. Y. The company proposes to deal in metallic tungsten and tungsten acid, etc.

New Incorporations

MONTEVALLO, ALA.—The Montevallo Lt. & Ice Co. has been organized by the Brown Brothers Lumber Co. to install an ice and cold-storage plant.

TEXARKANA, ARK.—The Hardin El. Co. has been incorporated with a capital stock of $10,000 by James W. Morris, William J. Morris, Arthur S. Herrington and others.

SAN FRANCISCO, CAL.—The Aero Pwr. Co. has been incorporated with a capital stock of $75,000 by O. E. Sill, H. E. White and W. H. Buttner. The headquarters of the company will be located in San Francisco.

STOCKTON, ILL.—The Stockton El. Co. has been incorporated with a capital stock of $25,000 by John W. Sayer, Harrison A. Smith and C. H. Rinderbach. The company proposes to operate a heat, light and power plant.

UNION CITY, IND.—The Union City El. Co. has been incorporated with a capital stock of $100,000 to operate public utilities. The incorporators are: J. S. Dales, Robert Cass, T. S. Monks and G. H. Fisher.

OWENSBORO, KY.—The Daviess County Telephone Co. has been incorporated with a capital stock of $50,000 by William W. Crawford, William T. Hale and J. J. Hettinger.

IDABEL, OKLA.—The Bettes Pwr. Co. has been incorporated with a capital stock of $2,000,000. The company proposes to establish a hydro-electric power plant on Mountain Fork River, in McCurtain County, for the purpose of supplying Texas, Arkansas and Oklahoma towns with electricity for lamps and motors. A dam 150 ft. high and 350 ft. long will be built. The incorporators are: J. M. Bettes, of Muskogee; R. S. Bettes, of Paris, Tex.; George A. Carden, of Dallas, Tex., and J. R. Clark, of San Antonio.

HARRISBURG, PA.—Six charters for companies to operate in Butler County have been granted by the State Department as follows: Cranberry, Canter, Chicora, Fairview, Oakland and Parker. Each company is capitalized at $5,000 and takes the name of the district it is to operate in. The incorporators are: H. C. Carpenter, R. E. Sprenkle and C. R. Bartley, of Butler.

PHILADELPHIA, PA.—Charters have been granted by the State Department to six electric companies to operate in towns along the railway of the Philadelphia & Western Ry. Co. between Sixty-third and Market Streets, Philadelphia, and Bridgeport. The companies are: The Millbourne Lt. & Pwr. Co., of Upper Darby Township; the Gulph Lt. & Pwr. Co., of Upper Merton Township; the Interborough Lt. & Pwr. Co., of Bridgeport; the Cooperstown Lt. & Pwr. Co., of Haverford Township; the Gladwyne Lt. & Pwr. Co., of Lower Merion Township, and the Ithan Lt. & Pwr. Co., of Radnor Township. Each company is capitalized at $5,000. It is understood that a plant will be erected in each place. Energy for operating the system will be secured from the railway company. The incorporators are: Thomas Newhall, of Ithan; Julius L. Adams, of Norristown, and Gerald Holman, 2018 Locust Street, Philadelphia.

ROGERSVILLE, TENN.—The Rogersville Hydroelectric Pwr. Co. has been chartered with a capital stock of $5,000 to build a hydroelectric power plant on Big Creek, 3 miles from Rogersville. The incorporators are: J. E. Miller, George D. Hale, L. L. Charles and others.

CHARLOTTESVILLE, VA.—The Red Land Pwr. Corpn. has been incorporated with a capital stock of $400,000. The officers are: F. C. Todd, president, W. Allen Perkins, secretary and treasurer, both of Charlottesville.

FAIRMONT, W. VA.—The Fairmont-Clarksburg Pwr. Co. has been incorporated with a capital stock of $50,000 by John W. Fleming, J. M. Broomfield, M. A. Joliffe and others.

Trade Publications

STEAM SPECIALTIES.—A sixty-four-page catalog has been issued by John Acton, 118 John Street, Brooklyn, N. Y., devoted to automatic steam, water and air vacuum specialties, fully illustrated with cuts and diagrams.

RECORDING INSTRUMENTS.—Foxboro recorders are made the subject of a folder issued by the Industrial Instrument Company, Foxboro, Mass. Fifteen different types of recording instruments are illustrated and briefly described.

GRAB BUCKETS.—The Pawling & Harnischfeger Company, Milwaukee, Wis., has made its "P. & H." single-line grab bucket the subject of its Bulletin No. 101. The twelve pages show the construction and operation of this apparatus.

WATER WEIGHER.—A miniature leaflet of eight pages has been issued by the Kennicott Water Softener Company, Chicago Heights, Ill., which gives practical facts and figures regarding the Kennicott water weigher in the power plant.

METERS.—The Holcomb & Hoke Manufacturing Company, Indianapolis, Ind., has recently issued an eight-page booklet referring to "H and H" watt-hour meters. The constructive features are clearly set forth. The booklet is well printed, contains excellent illustrations and has an attractive cover.

BOILER CLEANERS.—The Lagonda reseating machine is made the subject of Bulletin G-1, issued by the Lagonda Manufacturing Company, Springfield, Ohio. It describes the construction and use of its portable carborundum wheel for removing soot and scale from the faces of caps and tube ends on boilers.

LIGHTING FIXTURES.—The F. W. Wakefield Brass Company, Vermilion, Ohio, has issued a folder which gives a brief talk on its general lighting fixtures and illustrates and refers specifically to the Wakefield coupling or adapter which furnishes a practical method of attaching a rigid arm to a ceiling fixture.

HOUSEHOLD DEVICES.—"Take Drudgery from Housework" is the title of a small folder bearing the imprint of the Federal Sign System (Electric), Chicago, Ill., which contains small illustrations and brief descriptions and prices of the numerous "Hotpoint" devices for use in the home or office or when traveling.

REINFORCING POLES.—"Making Old Poles as Good as New" is the title of a small folder recently issued by the Pittsburgh Reinforcing Pole Company, Pittsburgh, Pa., which shows the economical method of pole-line maintenance. It contains a clear, succinct talk on and two effective illustrations showing the Orr reinforcing process.

VACUUM HEATING SYSTEM.—A twelve-page bulletin has been issued by the Monash-Younger Company, Chicago, which gives brief outlines of the operation of the Monash noiseless radifier for vacuum heating systems, pressure-regulating valve, vacuum pump governor, Atlas noiseless back-pressure valve, dirt pockets and suction strainers.

MOLONEY ELECTRIC COMPANY, St. Louis, Mo., has recently opened two new Canadian offices, one at Vancouver, B. C., at 825 Vancouver Block, under the management of Mr. Seth B. Smith, and another at Winnipeg, Man., at 901 Street Railway Chambers Building, under the management of Mr. C. H. Abbott, formerly of the Packard Electric Company, of St. Catharines, Ont.

FUSES.—A little folder bearing the title "Starting Something in Philadelphia" refers to the installation of the first Detroit ironclad fused switch in the plant of the Curtis Publishing Company by the Detroit Fuse & Manufacturing Company, 1400 Rivard Street, Detroit, Mich. Following the statement that in the same building there are now 300 of these fused switches are some brief paragraphs on this device. Four types of switches and a view of the Curtis plant illustrate the folder.

ELECTRIC APPLIANCES.—The Hotpoint Electric Heating Company, Ontario, Cal., is sending out a "noveletter" in the form of a broadside which contains a fac-simile of one of the double-page advertisements used in its general publicity campaign. A special proposition is made to dealers in connection with "Hotpoint" household appliances, for which there is to be a special "national sale day" May 10. A broad educational campaign has been going on for some time having for its object the instruction of the lay public on the use and convenience of "Hotpoint" devices.

Business Notes

DUNCAN, YOUNG & PRESSEY, INC.—Mr. Louis Duncan, consulting engineer, has moved his offices from 55 Liberty Street to 50 Church Street, New York. Associated with Mr. Duncan are Messrs. S. Marsh Young and Henry A. Pressey, under the firm name of Duncan, Young & Pressey, Inc.

THE CONLON-SIMPLEX MACHINE COMPANY, INC.—The "Simplex" electric home laundry machine will shortly be placed on the market by the Conlon-Simplex Machine Company, Inc., 2 Rector Street, New York. Mr. W. J. Conlon and Mr. W. T. Haynie, of this new concern, have previously been manager and sales manager respectively of the Hurley Machine Company.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED APRIL 15, 1913.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,058,724. SUPERVISORY SIGNAL SYSTEM; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Combination of an auxiliary fire alarm with a watchman's supervisory signal system.

1,058,725. COMBINED AUXILIARY AND AUTOMATIC FIRE-ALARM SYSTEM; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Automatic signaling devices operated by thermostats and a code-signal transmitting means operated by automatic signaling devices.

1,058,728. ELECTRIC SIGNAL-TRANSMITTING APPARATUS; F. W. Cole, Newton, Mass. App. filed April 15, 1910. Multiple signal-transmitting device adapted to send a number of different signals.

1,058,730. REVERSIBLE BRUSH HOLDER FOR USE WITH DYNAMOS; J. L. Creveling, New York, N. Y. App. filed Aug. 25, 1911. Direction of current supplied is maintained uniform throughout reversals in direction of armature rotation.

1,058,731. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed Sept. 16, 1910. Constant voltage on a translation circuit is maintained throughout changes in the voltage at the source; use is made of carbon pile and electromagnetic means exerting pressure thereupon.

1,058,761. TROLLEY FINDER; A. Klein and J. Poss, Chicago, Ill. App. filed July 1, 1912. Finder arms rise on opposite sides of trolley wire when pressure on the trolley wheel is released.

1,058,778. STORAGE BATTERY; W. Morrison, Des Moines, Ia. App. filed Aug. 31, 1912. Uses a compound of titanium for a binder.

1,058,779. SEPARATOR FOR STORAGE-BATTERY PLATES; W. Morrison, Des Moines, Ia. App. filed Sept. 7, 1912. Wood separator plate heated in melted wax to drive off volatile ingredients and then the residual bath material is dissolved from the wood.

1,058,800. SILICON-CARBIDE ARTICLE AND METHOD OF MAKING THE SAME; E. S. Smith and F. J. Tone, Niagara Falls, N. Y. App. filed April 26, 1912. Porous silicon-carbide which is non-crystalline under naked vision and is characterized by extreme fineness of particle and pore.

1,058,825. ELECTRIC HEATING PAD, BLANKET, ROBE AND THE LIKE; F. R. Whittlesey, Oakland, Cal. App. filed April 1, 1912. Current-carrying wire is arranged in tortuous course and secured to foundation sheet by narrow tape.

1,058,832. SYSTEM OF ELECTRICAL DISTRIBUTION; J. L. Woodbridge, Philadelphia, Pa. App. filed Nov. 10, 1909. Motor is responsive to departures from predetermined condition of battery circuit and acts to control regulating apparatus to vary the load on the generators.

1,058,851. SELF-ADJUSTING OUTLET BOX; O. F. Dubruiel, Duluth, Minn. App. filed Jan. 4, 1912. Made in two relatively movable parts so that box may adjust itself to settling of house without breaking joints.

1,058,872. SIGNALING SYSTEM; O. T. Lademan, Milwaukee, Wis. App. filed July 29, 1910. Impulse mechanism at each station with signal-sending devices at central station arranged so central station can selectively call any substation.

1,058,899. MOTOR VEHICLE; H. Pieper, Liege, Belgium. App. filed March 29, 1907. Power developed by engine is controlled by means depending on the equilibrium, setting of the controller and speed of the dynamotor shaft.

1,058,902. PLAYING APPARATUS FOR MUSICAL INSTRUMENTS; W. C. Reed, Dalton, Mass. App. filed May 26, 1910. Special electric circuit for varying strength of current to playing magnets with music sheet having special perforations.

1,058,903. TELEPHONE-EXCHANGE SYSTEM; J. N. Reynolds, Greenwich, Conn. App. filed July 8, 1911. Controlling circuit for reversive-control power-driven automatic switches used in automatic or semi-automatic exchange systems.

1,058,916. BATTERY INSTALLATION; L. Y. Spear and G. E. Edgar, Quincy, Mass. App. filed March 13, 1911. For boats, autos, etc.; tank for the battery cells with ventilating pipes and automatic sealing valves to prevent entrance of water.

1,058,986. APPARATUS FOR CONTROLLING ELECTRIC-LIGHT SYSTEMS; A. W. Knutson, Galesburg, Ill. App. filed March 21, 1910. Particularly for "boulevard systems;" cuts out a predetermined portion of the lamps in a circuit simultaneously and from a single point.

1,058,991. PROCESS FOR THE PRODUCTION OF MALLEABLE IRON DIRECT FROM ORE; A. R. Lindblad, Ludvika, Sweden. App. filed July 16, 1910. Mixture of ore and reducing material is treated in shaft furnace and after being fully or partially reduced is passed without cooling or contact of air into an electric melting furnace.

1,059,002. RECTIFIER; C. C. Ruprecht, Cleveland, Ohio. App. filed Nov. 18, 1907. Cell containing electrolyte and electrodes, one of which surrounds the other and has a closed chamber at the top thereof to collect gases liberated by decomposition of electrolyte.

1,059,003. METHOD OF AND APPARATUS FOR RECTIFYING ELECTRIC CURRENTS; C. C. Ruprecht, Cleveland, Ohio. App. filed April 20, 1908. Pressure is maintained upon the electrolyte by obstructing the discharge of gases from the cell.

1,059,004. ELECTRIC MEASURING INSTRUMENT; M. C. Rypinski, New York, N. Y. App. filed May 4, 1908. Single instrument indicates voltage of circuit connecting electric motor to storage battery, the charging current applied to the battery, or the current supplied from the battery to the motor.

1,059,007. ELECTRICAL BURGLAR ALARM; B. F. Sharp, Ambler, Pa. App. filed May 21, 1912. Alarm element with plurality of circuits and circuit-opening and circuit-closing devices.

1,059,011. TROLLEY; E. Swinarski, Buffalo, N. Y. App. filed May 3, 1912. Retaining arms at opposite sides of trolley remain upright regardless of inclination of the trolley pole.

1,059,013. REGULATED-CONTACT PUSH-BUTTON; B. Urquhart, Plainfield, N. J. App. filed Oct. 5, 1909. Primary and secondary pistons regulate duration of contact regardless of duration of pressure thereon.

1,059,014. OZONIZER; C. F. Wallace, New Brighton, N. Y. App. filed Aug. 21, 1911. Spaced concentric glass tubes with an electrode on the outside of the outer tube and an electrode on the inside of the inner tube.

1,059,048. FRAME OF DYNAMO-ELECTRIC MACHINES; F. C. Hall, Wilkinsburg, Pa. App. filed June 9, 1910. Segments of the frame have adjacent tapered projections and a cap is clamped over these projections.

1,059,056. ELECTRIC SWITCH; L. F. Lindstrom, Bridgeport, Conn. App. filed Nov. 20, 1912. Pawl and ratchet circuit-breaker with segmental clutch plate, having slitted portions at its edge bent to form a channel for the chain.

1,059,071. ELECTRIC WASHING MACHINE; R. D. Robinson, New York, N. Y. App. filed June 20, 1912. Electrodes are cleansed while in assembled condition in the machine by reversing flow of current; amperage is controlled by lamps.

1,059,073. ANTISEPTIC TELEPHONE MOUTHPIECE; I. S. Rosenbalt, San Francisco, Cal. App. filed May 25, 1911. Rigid body of disinfectant material is inclosed in an air-tight casing which supports the mouthpiece.

1,059,076. ELECTRIC PLANT; O. Schaller, Steglitz, Berlin, Germany. App. filed Aug. 7, 1907. Car-lighting system; double-direct-current generator driven by car axle and a motor booster.

1,059,086. IGNITING DEVICE FOR GAS STOVES; B. D. Stevenson, Harvard, Ill. App. filed May 22, 1911. Induction coil and selective push-button control.

1,059,090. ELECTRIC MASSAGE ROLL; D. Tibbals, St. Louis, Mo. App. filed Sept. 24, 1909. Induction coil within the handle which carries the roll, variable connections inside the handle and controller on outside of handle.

1,059,095. HIGH-VOLTAGE-MEASURING INSTRUMENT; J. B. Whitehead, Baltimore, Md. App. filed April 5, 1912. Two concentric conductors, one of which has a diameter corresponding to a given critical intensity.

1,059,096. SYSTEM OF CHARGING SECONDARY BATTERIES; J. A. Wotton, Atlanta, Ga. App. filed May 6, 1909. Mercury-vapor rectifier, voltmeter influenced by battery current and electrical means actuated by voltmeter for discontinuing one leg only of the alternating-current circuit.

1,059,120. SPARK COIL; W. H. Cotton, Chicago, Ill. App. filed Jan. 25, 1912. A pair of insulated magnet blocks are apertured to receive the coil and each is connected to one end of the coil.

1,059,131. TROLLEY SWITCH; L. E. Elwell, Los Angeles, Cal. App. filed July 29, 1911. Special construction for holding and clamping the trolley wires at a switch point.

1,059,134. COMMUTATOR MOTOR; C. W. Fornander, Wilkinsburg, Pa. App. filed Aug. 26, 1911. Single-phase commutator-motor brush is made up of plurality of conducting laminae bearing a definite spaced relation to spacing of commutator bars.

1,059,172. MEDICAL CABINET; I. H. Lewin, New York, N. Y. App. filed Dec. 10, 1912. Hand-and-foot operating mechanism located in a cabinet with insulated contacts mounted on said mechanism.

1,059,233. ELECTRODEPOSITION AND REFINING OF ZINC; U. C. Tainton and J. N. Pring, Manchester and Sandbach, Eng. App. filed March 16, 1912. Electrolyte consisting of zinc salt solution, a large proportion of an acid and a small proportion of gum tragacanth.

1,059,255. SYSTEM FOR CHARGING SECONDARY BATTERIES; J. A. Wotton, Montclair, N. J. App. filed May 6, 1909. Battery-charging circuit including circuit-breaker and controlling means therefor, electromagnet for short-circuiting the controlling means, and battery-voltage-actuated means for energizing the magnet.

1,059,304. MERCURY DROPPER; E. C. Ketchum, Boston, Mass. App. filed March 18, 1912. An amalgam containing sodium is intermittently fed to the armature at the point of contact of the brush.

1,059,314. BATHING APPARATUS; A. J. Petter, Los Angeles, Cal. App. filed June 12, 1912. Electric-light cabinet containing tub and a support for the patient.

1,059,322. ELECTROLYTIC APPARATUS FOR THE PREPARATION OF PAPER PULP; F. F. Strong, St. Petersburg, Fla. App. filed June 10, 1910. Porous tube for the flow of subdivided plant material, electrode within the tube, and a tank supporting an electrolyte around the tube.

1,059,326. PROTECTED TERMINAL CLAMPING DEVICE; A. H. Ackermann, Brooklyn, N. Y. App. filed May 2, 1910. A conducting stud is clamped between adjacent cells of storage battery and acid-proof caps inclose the clamping nuts and the ends of the conducting stud.

1,059,328. ELECTRICAL INDICATING OR RECORDING APPARATUS; W. H. Bristol, Waterbury, Conn. App. filed March 30, 1912. The mounting for the movable members of the instrument is located so that it will not be affected by the heat generated in the coils or by eddy currents.